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VOL. IX MARCH-APRIL, 1921 No. 8-9

EDITORIALS

DOCTOR ALBERT

During the past five years no one has held so close a relation to public instruction in the Philippines as has Dr. Alejandro Albert who was relieved of his duties of acting president of the University of the Philippines on April 4 and assumed the position of acting secretary of public instruction. Doctor Albert's permanent position in the Philippine Government has been for some time that of under-secretary of public instruction, but the variance of appointment and absence of other men has thrown upon him increased duties including the presidency of the University, an assistant directorship of the census, and a membership of the Council of State. In the performance of his very many duties he has satisfied a myriad of routine details; he has dealt justly with his personnel; he has worked and built; he has exemplified the office of a good servant of his nation and his race; and under a burden of arduous duties, such as no other member of the Government has borne, he has maintained a friendly good humor and honest grace in his contact with all men.

The College of Agriculture and the staff of the *Agriculturist* desire to express to Doctor Albert their appreciation of his work while head of the University and to wish him continued success and good health.

THE NEW UNIVERSITY HEAD

Dr. Guy Potter Benton has been elected by the Board of Regents to be president of the University of the Philippines. The staff of the *Agriculturist* and the College of Agriculture, faculty and students, wish to extend him a cordial

welcome to that seat of high service. They believe that Doctor Benton brings with him unusual ability in surmounting those difficulties which normally occur in a young growing institution. They discover with pride that his record bespeaks hard work and great energy; a life-progress forged of endeavor and vim; a career singularly noted in its quality of gradually developing achievement. They assure him of their trust and co-operation and solicit his confidence and good will to the end of erecting still higher the edifice of Philippine education.

RESEARCH FELLOWSHIPS

A recent note from Doctor Trelease, formerly of the department of Plant Physiology of the College of Agriculture, contains a very pertinent suggestion which should be given close consideration. To quote Doctor Trelease:

> " * * * have three or four research fellowships for American graduate students established at the College * * * in entomology, plant pathology, and plant physiology. Let each one pay the fellow ₱2400 a year. Give desk space and all materials to the fellows. Make an arrangement by which the fellows may travel on transports. I believe these would attract American students, and surely the research would be of great value to the Islands."

The proposition opens up a vision of broad usefulness and reciprocal advantage to the College. The environs of the College furnish one of the world's best living laboratories of natural science. The scheme would happily correlate with the recent foundation of the Makiling National Botanic Garden. More and more the world comes to depend upon tropical production for the expansion of its vital industries. A wide future for agricultural science lies in the tropics. As things stand Java, India, and the Philippines must meet the demand for tropical research in the sciences fundamental to agriculture. They cannot avoid this responsibility to world progress and they may profit by seizing the earliest opportunities for fulfillment that come their way.

In the past the College has profited by the visits of scientists. Dean Baker called attention to this fact in a former number of the *Philippine Agriculturist;*[1] mentioning Prof. L. Bruner of Nebraska State University who gave the Islands a complete bibliographic list of the orthopterous insects of the Philippines; Mr. F. Muir, Dr. H. R. Osborn, and Dr. F. X. Williams of the Hawaiian Sugar Planters Experiment Station whose work in economic entomology has been of high value; Mr. W. T. Swingle, of the United States Department of Agriculture, who established here an introduction orchard of citrus; Dr. W. H. Weston, of the United States Department of Agriculture, who worked on the Philippine downy mildew of maize; and many others whose accomplishments represent great utility at *no cost* to the College.

To continue on a firm footing this opportunity for profit and as a meagre testimony of the local value of such investigations, the establishment of several fellowships such as Doctor Trelease advises would be a long step forward for the College and for the country.

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[1] Baker, Charles Fuller. Foreign specialists who have visited and worked at the College of Agriculture. **Philippine Agriculturist 8**: 3-5. 1919.

THE MAKILING NATIONAL BOTANIC GARDEN

The importance and significance of the creation of the Makiling National Botanic Garden by Governor General Harrison has been set forth fully by Dean Baker in his interview in the *Manila Times*, January 3. Some of the advantages of this Garden which is thus to be reserved for the development of scientific knowledge, not only in botany, but in forestry and agriculture likewise, will easily bear further emphasizing, though their general features are admirably outlined by Dean Baker.

Perhaps the greatest opportunity on Mount Makiling is for forestry research. There is always need in forestry, even more than in the other arts, for long-continued studies of the development and evolution of natural vegetation. To develop rational management, foresters need to first know what is the natural tendency of each component of the forest. This can best be studied in areas which have remained undisturbed for long periods. For economic reasons, it is often difficult to retain such areas. The Mount Makiling Botanic Garden will have many such areas, if its real purpose is adhered to. Secondly, in artificial plantations, it is often desirable to know what would be their ultimate fate, if allowed to attain natural maturity, instead of being cut as soon as they attain marketable size, as they usually are. If such plantations are established in this Garden, they may be reasonably retained indefinitely, and we may thus learn their development, not only to sizes now regarded as most advantageous, but to any greater size as well and to observe whether these exotic trees will naturally reproduce themselves and in what manner. A case in point came to my attention in Australia. There, the Monterey pine from California is grown for the home markets, and is cut at thirty to thirty-five years, when it yields large quantities of low lumber. On account of the great demand for this class of lumber, none of these plantations have been allowed to grow old, and it is not known definitely whether this species of tree, or any other imported conifer, will develop satisfactorily into large clear saw timber or not. This sort of investigation into the ultimate development of such growing crops, is inadvisable for commercial forests, but is a highly important function of a permanent Garden like Makiling. Another and equally important feature of such permanent plantations is for an arboretum. Foresters cannot be particularly impressed with the large, spreading isolated shade trees, which often serve as the only representatives of important timber trees in many Botanic Gardens and Arboreta. They prefer to see what each tree will develop into when subjected to truly forest conditions. With the large area now permanently set aside for research, it will be possible to have real forest stands of all of the trees which can be grown in this region. The Forest School has already made an excellent start in this direction in the plantations initiated by Mr. Curran and Doctor Foxworthy.

The Flora of Mount Makiling, now being prepared by the Bureau of Forestry, will be of the greatest assistance to students of the vegetation of our National Botanic Garden. Since the studies here are, by no means, confined

to the woody plants, but quite properly extend to all elements in the natural flora, as well as plants introduced for special studies, this Flora may now be extended by the Bureau of Science, and be made to include all forms of vegetation. Nor should this sort of work be confined by any means to the plants. The Garden will fall far short of attaining its highest usefulness, if its fauna is not likewise thoroughly investigated, and problems in ornithology, zoology, and entomology be given equal weight with botanical studies.

In the field of botany, the garden offers excellent opportunities for studies of all sorts, particularly in physiology and ecology. This subject has already been discussed at considerable length in the co-operation number of the *Agriculturist*[1], as has also its advantages as a biological station[2]. By properly combining studies along different lines it will be possible to show the interrelationships between the different components of the forest, and to study the natural balance between different forms of plants, of animals, and of insects. The preservation of the natural growth and restriction of removal of the native plants from the Garden will also facilitate observation and study of many striking and ornamental native plants which are rapidly disappearing from most accessible forests, such as Nepenthes, the Mariposa orchids, etc. The preservation and restoration of such plants on Mount Makiling will add materially to its scenic beauty, as well.

Many important agricultural studies can also be carried out within the Botanic Garden. A beginning has already been made in coffee, abaca, and fruit trees. These can now be continued with firm assurance of their permanency. These may properly be extended by introductions of varieties of tea, chincona, and various spice plants, food plants, etc., which thrive best in mountain or forest conditions. There is also a wide field for investigation of the real merits and susceptibility to cultivation of the many excellent native food plants. Among these a number of the fruits have already received some attention.

The value of Mount Makiling as a resort should not be lost sight of. To this end, a well planned system of roads and trails should be built, thus making the Garden accessible to the general public as well as to visiting scientists. This is extremely important, for we cannot hope to have this great national asset fully appreciated and the work on it whole-heartedly supported as long as the only means of access to it is by rough footpaths, oftentimes nearly blocked with debris. A well-surfaced road through the forest to its summit, leading to the points of greatest interest, and connecting with well-surfaced horse trails radiating to experimental areas, and bits of natural forest best fitted for study and observation, would add immeasurably to the attraction of the mountain. A well-equipped rest house, constructed of permanent materials, should also be placed at the summit, for the use of investigators working on the upper part of the mountain. Since Mount Makiling is the most accessible high mountain near Manila, it certainly deserves to be much better known than it is, and this can only be accomplished by opening it up with roads and trails.

FORMAN T. MCLEAN.
Of the Department of Plant Physiology.

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1 TRELEASE, SAM F., and MCLEAN, F. T. Mount Makiling as a station for botanical research. **Philippine Agriculturist.** 8: 6-16. 1919.

2 MUIR, F. Makiling as a biological station. **Philippine Agriculturist.** 8: 17-18. 1919.

THE ORIGIN AND POSITION OF VETERINARY SCIENCE

The profession of veterinary science had its birth in a horseshoeing shop. Men who shod horses naturally came in close contact with ailing animals, particularly with lame horses. It is natural to suppose that these men were eager to relieve the dumb beasts with which they came in contact and notwithstanding the fact that these men were uneducated, in many cases were even unable to read and write, they were looked to for advice and guidance when anything was found abnormal with the locomotory apparatus of the horse. Often, they were able to render assistance by the application of their own art of blacksmithing. They could wield the hammer and shape shoes and trim feet in such a manner as to properly balance a horse, thereby accelerating and improving the gait. This was done by properly wielding the hammer and trimming the foot, without any knowledge of the anatomy of the horse's foot, or the functions of the different parts which compose it. Even to this day the better part of the blacksmith's art is of great assistance and value to the veterinarian.

Referring back to the birth of the profession, in the early days horses received the most consideration and the horse-shoers, who were in fact our first veterinarians, were the logical men whom owners relied upon when anything became abnormal with the horse. As time advanced these early "veterinarians" did not confine their activities to the horse's feet. They acquired knowledge of certain drugs, usually through the advice of some practitioner of human medicine, and these they administered, usually, however, confining themselves to the mildest purgatives. These were given without knowledge of the anatomy of the digestive tract or the physiological changes which take place therein.

This condition of affairs continued until other species of livestock as cattle, sheep, goats, swine, poultry, and pet stock were developed and improved. As the animal industries were developed, livestock owners with the law-makers, realizing the economic importance which animals were coming to play in civilization, demanded that men, in order to be able to administer to the ailments of livestock, should be educated. Educated, not only in the basic sciences upon which the great structure of agriculture is built as a preliminary foundation, but thoroughly informed in animal anatomy, medicine, physiology, pathology, and bacteriology. Not more than twenty-five years ago, as a result of these demands, large funds were made available for the purpose of erecting colleges and equipping laboratories in order to teach men to become capable veterinarians.

Veterinarians are, perhaps as a consequence of their origin, constantly being looked upon as authorities on questions of feeding and breeding of animals, and in order to maintain their prestige, they cannot now retire behind the statement that they are not animal husbandry men, but only veterinarians. The questions of hygiene and preventive medicine are being forced upon the veterinarians more today by livestock owners than ever in the past. And it is imperative that they be equal to the demands. As veterinarians are so intimately associated with the livestock interests of a country, their presence in a community must be made so essential to livestock owners that they cannot afford to

get along without them, as it is an outstanding fact, that the only excuse for the existence of our profession is a well developed animal industry.

Today, some of the schools in America have realized the interrelation of veterinary science with animal industry, and have regulated their curricula so that students of animal husbandry are enabled to take a degree in veterinary medicine with two years additional work after they have completed their regular animal husbandry course of four years, and *vice versa*. This is a happy combination, and the only change that may be suggested as an improvement is that the entire six years of study be required before either degree is conferred, and then one which would carry both qualifications.

In the Philippines, animal industry is not organized, and its development is not in accordance with the standards of other activities of agriculture in the country. We have no cattle associations, no horse associations, and no swine or carabao associations. There was once an attempt at forming a poultry association, which for some reason has not asserted itself as it should have done.

The statement that the only excuse for the existence of a veterinary profession is an animal industry, and the fact that the animal industry is not organized in the Philippines, and its development is not what it should be, does not mean that the profession has no place in this development and organization. Statistics show that more than ₱6,000,000 worth of animals died of disease during the year 1919 in this country. In addition to this loss, more than ₱4,000,000 worth is reported as having died of other causes, one half of which can be safely estimated as having died of disease also, the other half representing those dying from old age, floods, and typhoons. This would indicate that at least ₱8,000,000 worth of animals, and these estimates were made far below the present market prices for animals, die annually from the result of disease in the Philippines.

A double burden therefore falls on the veterinarian who is in the Islands today. He must lessen the existing enormous loss through disease and he must realize the essential relation of his profession to animal industry. He must do every thing possible not only to lessen disease but he must also emphasize the need of more, many more, animals. He must be ready and competent to organize livestock associations and bring about that day when, in each province of the Philippine Islands, there will be a well organized animal industry association and at the head of that association a veterinarian who is also a trained animal husbandry man.

Alonzo S. Shealy,
Acting Dean, College of Veterinary Science.

The world was made for the occupation of men who in freedom through trial win character.—*Charles W. Eliot.*

REGARDING PHILIPPINE DOWNY MILDEW OF MAIZE

During 1920, Dr. William H. Weston, Jr., carried on, at the College of Agriculture, an investigation of Philippine downy mildew of maize for the United States Department of Agriculture. The results of the study which are of immense value to the Philippine Islands, were published in the *Journal* of *Agricultural Research*[1] and were later reviewed by Dr. N. B. Mendiola of the College of Agriculture in the *Philippine Agriculturist*[2].

We are pleased to publish the following letter from Doctor Weston which gives valuable additional treatment of the subject.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY
WASHINGTON
OFFICE OF CEREAL INVESTIGATIONS

January 28, 1921.

Dr. N. B. Mendiola,
College of Agriculture,
Los Baños, Laguna Province, P. I.

Dear Doctor Mendiola:

I feel very gratified that you would review my paper on the downy mildew in such a comprehensive manner in the *Philippine Agriculturist.* One or two points, however, which are brought out in the review demand further discussion.

For example, under "symptoms" you say, "Of these, change of color is the most conspicuous but not the surest symptom. For example, it is known that in both the seedling and in older stages of corn plant there are strains which exhibit similar coloration as infected plants. The distinction between such natural strains and the plants infected with downy mildew still remains both for the mycologist and the geneticist to establish." This last sentence, however, gives a somewhat wrong impression, because in the case of the naturally discolored strains which you mention no Sclerospora is present in the tissues as can easily be shown by sectioning the discolored leaves and no "down" of conidiophores is produced on the surface of these leaves. The distinction, then, between these natural strains and the plants infected with the downy mildew is the presence of the downy mildew in the latter and is sufficiently clear so that there is no need for either the mycologists or the geneticists to establish any further points of difference.

The point that you bring out in your discussion of the malformation of the ear and tassel which I mentioned under "symptoms" is a good one. As you say, the correlation between these abnormalities and the presence of the mildew is not proved. On this point I collected none of the quantitive data that would be necessary to bring out such a correlation by the proper statistical methods.

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[1] Weston, William H., Jr. Philippine downy mildew of maize. **Journal of Agricultural Research 19:** 97-122. 1920.

[2] Mendiola, N. B. Review of "Philippine downy mildew of maize." **Philippine Agriculturist 8:** 331-334. 1920.

From extensive observations in the field among naturally infected plants and in the plots inoculated artificially I feel sure that there is a relation here. The work of Butler and Kulkarni in India, and of Ippolito, Traverso, and others in Italy, shows that Sclerospora characteristically deforms the reproductive parts of the plants attacked, and while I realize full well that abnormalities are frequently of genetic origin from having seen Mr. Collin's remarkable collection of such strains, none the less I believe that the deforming in the case of Philippine plants diseased with the downy mildew is related to the disease at least in some cases. It would perhaps be of interest for you to set some student to work determining whether there is a correlation between these abnormalities of ear and tassel in the infected plants and the presence of a disease. In amassing the data necessary for such work it would, of course, be absolutely necessary to be sure that the plants examined were, or were not, infected with Sclerospora. Dr. Reinking could undoubtedly aid you in this matter. If you do start any work of this sort I should be intensely interested in learning of its progress and would be very glad to lend any assistance possible toward furthering it.

Another point which you mention under "hosts" is the matter of the teosinte-maize hybrids. Your statement is as follows: "Weston states that hybrids of maize and teosinte are also susceptible to the disease and that the degree of susceptibility and the effect on the plants attacked are intermediate between those shown by the two ancestors. It is not stated, however, what variety of corn was involved in the cross and no data were given to support the latter observation." Perhaps I should have given further information on this point in the paper. The variety of maize was Boone County White, obtained from Mr. Collins here in the Department, and the teosinte was from the College of Agriculture. Boone County White is very susceptible to the downy mildew, resembling Guam and other large, slow-grinding types in this respect. The teosinte was much more resistant, the resistance being shown by the fact that the plants were less impaired in their growth than in the case of maize and supported the downy mildew with less harmful effect, both to the vegetative parts and to the reproductive structures. My statement that the teosinte-maize hybrids show an effect intermediate between those shown by the two ancestors is based on notes taken from such hybrids which were naturally infected in the field and from others which I myself inoculated, and I feel sure that in the case of this Boone County White, male, X teosinte, female, cross I am justified in saying that the effect is intermediate.

A second paper on the downy mildew is to appear shortly, and I will send you a copy when it appears. If I can be of any assistance in furnishing further data I shall be only too glad to do so.

Please remember me to Dr. Elayda, Dr. Gonzalez, Dr. Roxas, and the others who were so kind to me at the college.

Very sincerely yours,

(Sgn'd) Wm. H. Weston, Jr.
Pathologist.

Democratic people have no one to depend upon but themselves.—*Thomas Nixon Carver.*

THE SCOPE OF ANIMAL PARASITOLOGY

Although the view that animal parasites play an important rôle in the causation of disease was advanced long before the advent of scientific medicine, concrete evidence in support of that view has been furnished during the past few decades. Before the rise of bacteriology, weighty medical authority upheld the view that many diseases of man, including such dreaded scourges as cholera and plague, were caused by specific living organisms that were considered to be internal metazoon parasites. As a matter of fact, the view that diseases may be caused by living agents that thrive in the body of the diseased was expressed quite clearly by a number of writers on medical subjects during the middle ages as well as subsequently, almost up to the time that the rôle of bacteria as agents of disease was established beyond any question. In the absence of knowledge concerning micro-organisms the living beings causing disease were considered to be certain common intestinal parasites. These early views had as a basis certain repeated observations, namely, that during epidemics internal parasites are expelled from the body spontaneously. While adequate evidence concerning this phenomenon is lacking, it is by no means unreasonable to assume that with the rise of body temperature during febrile conditions, internal parasites are stimulated to increased activity and thus leave their usual location and find a way out of the host.

As a result of the early triumphs of bacteriology, the theory that worms and other metazoon parasites are responsible for disease was generally discredited, and parasitology was hurled from its pedestal. Divorced entirely from the field of medicine, it was transferred, so to speak, to the field of zoology where it was cultivated by many eager workers whose dominant passion was to describe as many new species as possible. The species-hunting proclivities, which characterized the activities of zoologists in the last century and which discredited them among their colleagues in other fields of science, reduced parasitology to a mere catalogue of names and technical descriptions. Studies in parasitology were pursued as diversions by men who "experienced a divine thrill" in hunting for zoological curiosities in the intestines of animals. The only attention which parasitology received from medical men was reflected in the notion that worms exercise a beneficial effect upon the host instead of a deleterious effect as had been formerly supposed. This notion gave rise to the view that parasitic worms are the "guardian angels of children".

The undisputed dominance of medical bacteriology as the science dealing with living organisms as agents of disease, was weakened as a result of discoveries that certain diseases of man such as malaria, syphilis, hookworm, trypanosome diseases, are due to zooparasites. Following these discoveries a number of diseases of man and animals in subtropical and tropical countries was found to be due to protozoa, and thus the science of protozoology, one of the subdivisions of parasitology, came to existence. Meanwhile the pathogenic rôle of parasitic worm was re-investigated and studies on life histories of parasites, the mechanical injuries which they cause, the chemical products which they elaborate, as well as studies

on treatment and prophylaxis, established the science of helminthology, another subdivision of parasitology, on a sound basis. Along with studies on protozoon parasites, the rôle of insects and other arthropods as intermediate hosts of protozoon and metazoon parasites was discovered, and medical entomology thus became part and parcel of parasitology.

Animal parasitology, a tripod, including protozoology, helminthology and medical entomology, has been definitely established as an important branch of medical science. So far as tropical countries are concerned, parasitology occupies a place of prime importance in medicine, since tropical diseases are to a great extent diseases of parasitic origin.

While a number of parasitic diseases of man in the tropics have been investigated with the result that methods of prevention, control, and treatment have been devised for what were formerly veritable scourges, parasitic diseases of livestock are in a large measure an unexplored field in comparative tropical medicine. That internal parasites, protozoon and metazoon, are responsible for numerous losses in domesticated animals in the Philippine Islands is almost beyond question. The field of parasitology offers opportunities for the solution of problems that will not only advance the progress of science but that will also add to the material prosperity of the country.

BENJAMIN SCHWARTZ,
Of the Department of Parasitology and Bacteriology.

NEWS ITEM FROM THE NATIONAL RESEARCH COUNCIL

A RESEARCH INFORMATION BUREAU

The National Research Council has established a Research Information Service as a general clearing-house and informational bureau for scientific and industrial research. This "Service" on request supplies information concerning research problems, progress, laboratories, equipment, methods, publications, personnel, funds, etc.

Ordinarily inquiries are answered without charge. When this is impossible because of unusual difficulty in securing information, the inquirer is notified and supplied with an estimate of cost.

Much of the information assembled by this bureau is published promptly in the "Bulletin" or the "Reprint and Circular Series" of the National Research Council, but the purpose is to maintain complete up-to-date files in the general office of the Council.

Requests for information should be addressed, Research Information Service, National Research Council, 1701 Massachusetts Avenue, Washington, D. C.

A STUDY OF THE EFFECTS OF ANIMAL AND PLANT PROTEIN FEEDS ON THE EGG PRODUCTION OF DUCKS[1]

By Andres Goseco

In order to be able to produce eggs, ducks, like hens, must have some extra nutrients besides those needed for body maintenance. Analyses of duck eggs show that they contain more protein than hen eggs. According to Robinson (1), hen eggs contain 11.9 per cent protein while duck eggs contain 12.1 per cent. Ducks, especially those which are reared near running water, obtain a natural protein supply from snails, crustaceans, bivalves, small fishes, etc. In cases where it is fed, the protein supply is obtained from beef scrap, tankage and other animal feeds. This is especially true when ducks are reared inland. Rankin (2), a successful American duck raiser, gives ten per cent beef scrap in his ration for laying ducks.

The protein for egg production can be supplied in either plant or animal feeds. Just which kind of protein with ducks gives the better results for egg production, has not yet been determined. With the hen, this problem of supplying protein in rations for laying birds has been thoroughly worked out by several investigators in various experiment stations in the United States. The majority of these investigators favor protein of animal origin. Ahrens (3) of the Oklahoma Station compared the effects of beef scrap and cotton seed meal on egg production, fertility, and vitality of poultry. He found that "as a feed for egg production beef scrap is superior to cotton seed meal and more than makes up for its greater cost by apparently causing greater production." Kempster (4) of the Missouri Station investigated the effects of various protein supplements for laying hens and reports the following:

Supplement	*Number of eggs.*
Beef scrap	120.3
Sour milk	129.0
Oil meal	64.9
Gluten meal	63.8
Cotton seed meal	66.0
No basal protein	57.3

Philipps (5) of the Indiana Station reports from his four-year experiment that the average production of hens fed with meat food was 132.8 eggs per year, while those which did not receive any meat food averaged only 32.5 eggs per year.

Under Philippine conditions, Fronda (6) of this College compared the effects of animal and plant proteins on the egg production of hens. He used snails for animal and copra meal for plant protein. He reports that the animal-protein-fed hens averaged only 36.25 eggs per year.

From the above results, it appears that animal protein is superior to plant protein for egg production in the case of hens. The work reported in this paper

[1] Thesis presented for graduation from the College of Agriculture, No. 118; Experiment Station, contribution, No. 47.

was undertaken with the object of determining which kind of protein will cause greater egg production with ducks. Snails were used to supply the animal, and copra meal, the plant protein. This experiment was conducted at the College of Agriculture, University of the Philippines, and it covered a period of exactly one year, from July 20, 1918, to July 19, 1919.

MATERIALS AND METHODS

STOCK USED

The stock used for this experiment consisted of eighteen laying ducks and four drakes, all of which came from the stock used by Alcasid (7) in his experiment in 1917-1918. These birds were, at the start, all healthy. The flock was divided into two lots, designated as Lot A and Lot B; each lot had nine ducks and two drakes. In the division of the flock into lots, care was taken so that uniformity in size, vigor, weight, etc., was secured for each lot. The birds in each lot were numbered 1-11 inclusive.

To determine whether the feeds had any effect on the weight of the birds, the individual fowls were weighed at the beginning and at the end of the experiment. Table I shows the weight of each bird, and the gain or loss in weight during the course of the experiment.

TABLE I.—*Giving weight of each bird at the beginning and the close of experiment.*

Lot A, snail-fed.				Lot B, copra meal-fed.			
No. of bird.	July 20 1918.	July 19 1919.	Gain or loss.	No. of bird.	July 20 1918.	July 19 1919.	Gain or loss.
	gm.	*gm.*	*gm.*		*gm.*	*gm.*	*gm.*
A-1	1138.0	1068.8	— 69.2	B-1	1128.0	1095.0	— 33.0
A-2	1060.0	deceased		B-2	1100.0	deceased	
A-3	1090.0	940.0	—140.0	B-3	1090.0	891.3	—198.7
A-4	970.0	916.4	— 53.6	B-4	965.0	804.1	—160.9
A-5	960.0	810.0	—150.	B-5	950.0	877.7	— 72.3
A-6	1150.0	1035.0	—115.0	B-6	1200.0	1056.0	—144.0
A-7	925.0	831.8	— 93.2	B-7	915.0	deceased	
A-8	830.0	deceased		B-8	828.0	803.4	— 24.6
A-9	985.0	900.8	— 84.2	B-9	1100.0	880.5	—219.5
A-10	885.0	855.0	— 30.0	B-10	845.0	deceased	
A-11	1037.0	deceased		B-11	905.0	860.9	— 44.1
Total.....	.....	.....	—735.2	Total...	.....	.....	—897.1

Table I shows that the birds in both lots lost in weight. The loss, however, was more pronounced in the copra meal-fed lot.

HOUSING AND YARDING

The flock used in this experiment was housed in a shed-roofed nipa house. It was fairly well ventilated and sunlight could get in, as the doors were opened in the morning. The house was divided into two equal compartments and each

was occupied by one lot. The birds were provided with sleeping boards and straw for nesting material.

For each compartment was a grass range of about 12.5 by 7 meters. Each range was divided into two sections in which the birds were turned loose to get green feed. During the dry season, when green feed was scarce, the sections were alternated so as to get a constant supply of green feed.

FEEDING

Rankin (2) states that soft food is more easily utilized in the duck's organization than in the hen's. The ducks used for this experiment were fed soft food, which consisted of a mash of equal parts by volume of palay (rough rice) and rice bran. The weights of the components were determined. In addition to this basal ration, to Lot A, live snails were given, and to Lot B, copra meal. Both snails and copra meal were weighed separately before feeding. The snails were given usually at noon, while the copra meal was fed with the mash at each feeding. Both lots had access to charcoal, grit, shells, and water.

Great care was exercised in giving the birds the feed. In the morning and afternoon they were given mash in feeding troughs. The copra meal was mixed with the mash of Lot B at every feeding time, while the snails were given separately at noon to Lot A. The birds were not fully fed in the morning so as to induce them to walk around the yard to forage for themselves, thus getting exercise while getting the green feed. In the evening, a full meal was given. The ground snail shells, grit, and charcoal were kept in separate self-feeders, and were open to the birds at all times.

The weights of the feeds consumed by the birds in each lot were recorded and are given in Table II.

TABLE II.—*Feeding record by months; number of birds fed and weight of feed.*

	Lot A.			Lot B.		
	No. of birds.	Mash.	Fresh snails.	No. of birds.	Mash.	Copra meal.
		kg.	*kg.*		*kg.*	*kg.*
July 20, 1918—July 31, 1918	11	18.01	9.21	11	17.6	5.5
August 1, 1918—Aug. 31, 1918	11	45.55	22.07	11	37.50	7.0
Sept. 1, 1918—Sept. 30, 1918	10.2	37.06	17.74	11	40.20	6.12
Oct. 1, 1918—Oct. 31, 1918	10.0	36.72	17.78	11	35.12	11.12
Nov. 1, 1918—Nov. 30, 1918	10.0	40.20	12.15	11	34.40	13.51
Dec. 1, 1918—Dec. 31, 1918	10.0	38.10	19.47	11	33.68	14.5
Jan. 1, 1919—Jan 31, 1919	10.0	27.04	20.73	11	32.82	12.57
Feb. 1, 1919—Feb. 28, 1919	10.0	30.40	17.40	11	25.80	10.48
March 1, 1919—March 31, 1919	10.0	37.85	18.74	11	29.10	13.3
April 1, 1919— April 30, 1919	9.2	27.50	20.74	11	23.70	10.30
May 1, 1919—May 31, 1919	8.0	23.0	19.90	10.8	21.80	8.50
June 1, 1919—June 30, 1919	8.0	29.30	17.21	9.08	22.2	10.5
July 1, 1919—July 19, 1919	8.0	24.0	9.45	8.0	16.4	7.5
Total	125.43	410.33	222.6	137.95	370.32	131.43
Average	10.45	39.26	21.30	11.49	33.10	12.30

Table II shows the average number of birds, the amounts of feed consumed and the average consumption of one bird in each lot. Referring to this table, it may be seen that the birds in Lot A consumed more feed per bird than the birds in Lot B.

In the afternoon, the birds were given full feed, all that they could clean up in one hour. It was apparent that the copra meal-fed lot did not have as good an appetite as the snail-fed lot and therefore did not consume as much feed.

This is in accord with Fronda's (6) results; he found that the hens fed with snails consumed more feed than those fed with copra meal.

The average number of ducks in one month, when one bird died, was computed according to the method used by Mariano (8). He found the "Total Possible Days" by multiplying the actual number of hens in the pen at the beginning of the month by the number of days in the month. In case a hen died some time during the month, due correction was made by subtracting the number of days remaining in the month after each death. By dividing the number thus found by the number of days in the month, he found the "Average Number of Hens".

ANALYSIS OF THE PROTEIN FEEDS

To determine the protein content, the analyses of both snails and copra meal were obtained. Only the moisture, ash, crude protein, and fat were determined. The following tabulation shows the results of the analysis:

Feed.	Moisture.	Dry matter.	Ash.	Crude protein.	Fat.	Undetermined.
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Snails	77.4	32.6	15.73	19.5	6.1	58.67
Copra meal	11.3	88.7	5.5	20.1	12.2	—

The copra meal was analyzed by Francisco O. Santos of this College; the snails by the writer. In analyzing the snails, the Kjeldal method for the determination of nitrogen was used. The fat was determined by the other extract method and the ash was determined by burning dry samples.

EGG PRODUCTION

The eggs laid by the ducks were gathered every morning between six and eight o'clock. Most of them were gathered from the floor of the house but occasionally some were found outside the house in the yard. The eggs were labeled Lot A or Lot B according to the compartment in which they were found. Some of the eggs in both lots were weighed in order to make a comparison of their size and weight.

Table III shows the monthly average number of ducks in the pens, their egg production, and the average number of eggs produced per duck in each lot. It can be seen that the ducks in the snail-fed lot averaged a greater number of eggs than those in the copra meal-fed lot.

TABLE III.—*Giving monthly egg-production and average number of eggs per duck for each lot.*

	Lot	July 20-31	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Total for the year.
Average number of	A	9	9	8.2	8	8	8	8	8	8	7.2	6.8	6.0	6.0	
ducks in the pen	B	9	9	9	9	9	9	9	9	9	9	8.8	6.6	6	
Monthly	A	18	44	51	30	55	33	57	68	57	53	17	47	24	553
egg-production	B	5	36	12	24	21	20	17	34	26	27	6	21	10	259
Average number of eggs	A	2.0	4.88	6.17	3.60	6.87	4.13	7.12	8.5	7.12	7.33	2.40	7.83	4.0	71.95
produced per duck	B	.55	4.0	1.30	2.66	2.33	2.66	1.88	3.66	2.88	3.0	.67	3.14	1.66	24.39

It will be noted from this table that only the average and not the individual egg production of the ducks was taken. The individual egg-production was not ascertained, because trapping each individual duck for this purpose would impair its productivity because of the nervousness of the birds.

The table incidentally shows the distribution of egg-production in the months of the year. It can be seen that the egg-production was fairly well distributed throughout the year, with the exception of May when the egg-production was lowest. This was probably due to the fact that during the month of May, the birds could get hardly any green feed in their yards, as the grass dried up because of the hot, dry weather.

WEIGHT OF THE EGGS

To determine whether the feeds had any effect on the size of the eggs, some were weighed on the day they were collected. Table IV shows the comparative weights.

TABLE IV.—*Giving comparison of the weight of eggs of the two lots.*

Lot.	Number of eggs weighed.[a]	Total weight of eggs.	Average weight of eggs.
		gm.	*gm.*
A	190	10,985.5	57.81
B	150	8,150.1	54.30
Difference			3.51

[a] Eggs were weighed on the same day they were laid.

Table IV shows the weights of some of the eggs produced. By reference to this table, it may be seen that there was a difference of 3.51 grams in the average weight of the eggs in favor of the snail-fed lot. This excess in weight shows that animal protein tends to make ducks lay heavier eggs than the copra meal protein. Fronda (6) found that snails and copra meal gave a difference of only 0.09 gram in the weight of the eggs produced, the excess being in favor of the snail-fed lot.

RELATIVE COST OF EGG PRODUCTION

Tables II and III give the total amounts of feeds consumed and the total number of eggs produced by each lot. In computing the cost of the feeds, the grit, snail shells, charcoal, and green feeds were disregarded.

The prices of the feeds were computed at the time prices were normal. The price of the different feeds per kilogram was as follows:

Rice (palay)	₱0.13	Copra meal	₱0.025
Rice bran	₱0.062	Snails	₱0.05

The eggs at the time the computation of the feeds was made sold at ₱0.06 each or ₱0.72 per dozen.

TABLE V.—*Showing relative cost of egg production.*

Lot.	Mash.	Copra meal.	Snails.	Total cost of feeds.	Eggs produced.	Gain or loss.
Lot A						
Snail-fed....	410.33 kg.		222.62 kg.		554	
Cost.....	₱39.39		₱11.13	₱50.52	₱33.19	₱17.33
Lot B						
Copra meal-fed.....	370.32 kg.	131.43 kg.			259	
Cost.....	₱35.55	₱3.28		₱39.83	₱15.48	₱24.35

Table V shows that in both lots the cost of the total feed consumed was greater than the cost of the total eggs produced. The losses were ₱17.33 in Lot A and ₱24.35 in Lot B. In considering these losses, it must be borne in mind that the birds in both lots did not have a normal egg-laying power, as they were under experiment and the conditions under which they were reared were in many ways adverse to them. The birds were also in their second laying year. From these results, it may be expected that on a commercial scale the chances of losing are less if snails are used as the source of protein than copra meal.

FERTILITY OF EGGS

The eggs produced in both lots were tested for fertility. Most of the tests were made in a Queen hot-air incubator with a capacity of 240 eggs. The eggs, after determining their fertility, were removed from the incubator and not allowed to hatch. This was done because the incubator usually hatches a very low percentage.

In the latter part of the experiment, broody hens were available from the College flock. Every broody hen was made to set. The eggs incubated were tested for fertility and then allowed to hatch. Table VI gives the fertility tests.

TABLE VI.—*Giving fertility test of eggs.*

Lot.	Number of eggs tested.	Number of eggs fertile.	Number of eggs infertile.	Fertility.
				per cent
A	271	239	32	88.19
B	122	97	25	79.50
			Difference.....	8.69

Table VI shows the number of eggs tested and the percentages of fertility. By reference to this table it may be seen that the eggs produced by the snail-fed lot had a higher percentage of fertility than the copra meal-fed lot, a dif-

ference of 8.69 per cent. This result is in accord with Fronda (6) who found that the eggs from the snail-fed hens gave an average fertility test of 84.6 per cent while those from the copra meal-fed hens gave 83.33 per cent.

HATCHABILITY OF EGGS

TABLE VII.—*Giving results of tests for hatchability of eggs.*

Lot.	Number of eggs incubated.	Number of eggs hatched.	Number of eggs unhatched.	Hatchability.
				per cent
A	132	37	95	28.03
B	68	19	49	27.90

Table VII shows that of the 132 eggs incubated for Lot A only 37 hatched, giving a percentage of 28.03 per cent, while of the 68 eggs incubated for Lot B only 19 hatched, giving a percentage of 27.90 per cent. These results show that there was practically no difference in the hatchability of the eggs in the two lots. Fronda's results average 50 per cent hatchability for the copra meal-fed birds and 43.13 per cent for the snail-fed ones.

MORTALITY OF BIRDS

The ducklings, when hatched, were taken from the nests and carefully labeled according to their respective lot. They were then confined in separate compartments of a chicken house with a cement floor. They were not fed until after twenty-four hours, when they were given a wet mash of fine rice bran and finely powdered hard boiled eggs. After a week, ground palay was added to the ration. The ration became more and more solid as the ducklings advanced in age and size. After two weeks, no more egg was fed and crushed snails were given instead.

Drinking water containing potassium permanganate was given the ducklings. When they were strong, they were allowed to run in the grassy yards.

Carefully cared for as they were, many of the ducklings died. The death was always due to cold and poor vitality. The following table shows the percentage of mortality.

TABLE VIII.—*Showing mortality of ducklings in each lot.*

Lot.	Number of ducklings hatched.	Number alive after four weeks.	Number dead.	Mortality.
				per cent
A	37	5	32	89.18
B	19	3	16	84.21
Difference				4.97

By reference to Table VIII it may be seen that the death rate was high in both lots. The ducklings in Lot A had a death rate of 89.18 per cent while those of Lot B had 84.21 per cent. The slight difference in these death rates shows that the ducklings from the copra meal-fed lot had a slightly higher vitality than those from the snail-fed lot.

Close observations were made on the mortality of the fowls in both lots. Every day the birds were visited and closely observed as to their health. When any bird was observed to be suffering from any disease, it was caught and isolated from the rest of the flock.

The first death was A-8. This bird was found dead in one corner of the house in the morning of September 9, 1918. Post-mortem examination showed that the death was caused by congestion and inflammation of the liver. The symptoms observed were:

Liver, greatly enlarged with blood vessels congested.
Liver, marbled or spotted white.
Liver, soft and easily crushed.
Lungs, pale.
Spleen, soft.
The other organs were normal.

The second death was that of duck A-11. This bird was found dead on the morning of April 9, 1919, in the yard near the house with a broken head. Post-mortem examination showed that the bird was normal in health and was in laying condition. It was suspected that some accident caused the bird's death.

On April 25, 1919, drake A-2 was observed to be unable to walk. He was caught and it was found that his shank had outgrown its legband and the wire made a cut in the shank. The band was removed and the wound treated. The cut was so serious, cutting some of the ligaments, that the bird continued to be lame. He did not eat well and became emaciated and finally died in the morning of May 16, 1919.

The fourth case of death was that of drake B-2, which occurred on May 27, 1919. The probable cause was a disease of the kidneys. The symptoms were:

Condition, good.
Heart, slightly enlarged and watery.
Liver, normal in size but spotted white.
Kidneys, enlarged with cheesy nodules.
Intestines, normal in contents.
Spleen, enlarged.
Lungs, dark.
Gizzard, normal in content.

On the evening of June 6, 1919, some birds in Lot B were observed to be lame. This trouble was found to be due to leg weakness. The birds were compelled to remain in the house until late in the morning, so as not to be exposed to dampness early in the morning. This precaution proved effective, as the lameness disappeared.

On the morning of June 8, 1919, duck B-7 was found dead in the yard. The post-mortem symptoms showed that the death was due to liver trouble.

The last death was of duck B-10, on June 10, 1919. The supposed cause of the death was articular gout. Post-mortem examination gave the following symptoms:

Heart, normal, big clots of blood found in big blood vessels.
Intestines, no parasite, normal.
Liver, apparently normal in size but dark in color.

Lungs, normal.
Kidneys, normal.
Diarrhea, shown by the soiling of the feathers.

SUMMARY AND CONCLUSIONS

1. The birds in both lots lost in weight during the progress of the experiment. The loss was, however, more pronounced in the case of the copra meal-fed birds (see Table I).

2. Each bird in the snail-fed lot consumed 39.26 kilograms of mash and 21.30 kilograms of snails while each bird in the copra meal-fed lot consumed 33.10 kilograms of mash and 12.30 kilograms of copra meal. This shows that the snail-fed birds consumed more feed than the copra meal-fed birds (see Table II).

3. The ducks in Lot A (snail-fed) produced 553 eggs during the whole year, or an average of 71.95 eggs per duck, while the ducks in Lot B (copra meal-fed) produced 259 eggs during the whole year, or an average of 24.39 eggs per duck. This shows that the ducks fed with snails produced nearly three times as many eggs per bird as those fed with copra meal (see Table III).

4. The 190 eggs weighed from those produced in Lot A (snail-fed) weighed 10,985.5 grams, or an average of 57.81 grams an egg, while the 150 eggs from Lot B (copra meal-fed) weighed 8,150.1 grams, or an average of 54.30 grams an egg. The difference in the average weights shows that the snail-fed ducks produced slightly heavier eggs than copra meal-fed (see Table IV).

5. The eggs produced in Lot A (snail-fed) had a fertility test of 88.19 per cent while those produced in Lot B (copra meal-fed) had 79.50 per cent. The difference in the fertility tests shows that the snail-fed ducks produced a greater number of fertile eggs than the copra meal-fed ducks (see Table VI).

7. There was no appreciable difference in the hatchability of the eggs produced in the two lots; that of Lot A (snail-fed) was 28.03 per cent while that of Lot B (copra meal-fed) was 27.90 per cent (see Table VII).

8. Mortality was greater among the ducklings from the snail-fed lot than among the copra meal-fed lot (see Table VIII).

9. Each lot lost three birds by death during the entire operation. The deaths occurred earlier in the snail-fed lot than in the copra meal-fed lot.

10. There was a noticeable effect of the feeds in the general make-up of the birds in each lot.

ACKNOWLEDGMENT

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COMPARATIVE TESTS OF THIRTY-TWO VARIETIES OF CORN[1]

By Emilio K. Morada

There are a number of varieties of corn in the College of Agriculture but very little is known about their comparative productions. Though many of the varieties were introduced several years ago, they have not yet been subjected to a comparative study. It is the purpose of this paper to report the relative merits of these varieties as judged from the results obtained in comparative tests.

Very little has been done on the subject of comparative productions in the Philippines. In an answer to a letter to the Bureau of Agriculture, inquiring about results of similar work, the writer received the information in the following tabulation concerning a variety test of corn, conducted at La Carlota Experiment Station in 1918 (1).

Variety Name.	No. of tests during the year.	Generation.	Total area planted.	Av. yield per Ha.	No. of days to maturity.	Remarks.
			hectares.	*cavans*[a]		
Cagayan Yellow	4	F_7	3.5	36.6	102	Area planted to ear test included.
Cagayan Mixed	1	F_4	0.5	19.8	109	Abandoned.
Loboo Yellow . .	3	F_7	1.5	18.7	98	Area planted to ear test included.
Calamba Yellow	3	F_7	1.5	20.5	105	Abandoned.
Cebu White . . .	1	F_1	1.0	14.9	105	Last 2 crops planted in October.
Moro White . . .	3	F_3	2.19	12.2	109	Yield reduced by animal pests.
Mexican June . .	3	F_3	0.017	8.0	120	Abandoned being a dent corn.

[a] A cavan of corn on the cob averages 30 kilograms in weight. Shelled corn averages 58.5 kilograms, according to the Bureau of Agriculture Standard.

This test shows that the different varieties and strains used gave different yields. The Mexican June, which is said to be a heavy yielder in the College, yielded the lowest in the above test. The College of Agriculture has for many years been growing different corn varieties and strains.

The work reported in this article was begun in May, 1919. The first, or rainy season planting was made on the College farm, while the second, or dry season cultures were made on the newly acquired Experiment Station land.

MATERIALS AND METHODS

VARIETIES TESTED

All native and foreign varieties and strains available and more or less acclimatized in the College were used. Besides these, three strains of Native Yel-

[1] Thesis presented for graduation from the College of Agriculture, No. 119; Experiment Station contribution, No. 48.

low Flint and one strain of Los Baños White Flint were obtained from neighboring farmers and included in the experiment.

Due to the fact that the original materials were introduced at different times, the seeds used were of different generations and seasons. The names of the materials used, the generations, and seasons of the seeds are shown in Table I.

PLAN OF THE WORK

A rectangular piece of land occupied by small citrus plants was used in the first planting. The citrus plants are in rows, eight meters apart in the row. The field was divided into plots, eight meters wide and one hundred sixty-eight meters long. There were 21 plots in all.

The ground is fairly level except at one end of the field, where it slopes a little. The soil is clay loam throughout. The field had been planted previously to different crops. Seven of the plots had been occupied with soy beans, while the other fourteen had been planted to corn.

The area planted to each variety was not the same for all varieties, as seeds of the foreign varieties were available in smaller amount. Each native variety was planted on 325 square meters of ground, and each foreign variety on 243 square meters, except one variety which occupied 162 square meters.

The same implements were used in the preparation of the soil throughout. The land was plowed three times and harrowed twice. Old stalks of corn were not removed, but were allowed to decay. Before planting, furrows one meter apart were made. The seeds were hand-sowed in hills about 75 centimeters apart, by the common method of planting. Three to four seeds were dropped in a hill. Two plants were allowed to grow in each hill.

Thirty-two varieties were planted. They were planted side by side so that cross-pollination took place, and hybrids were produced. In an experiment of this kind, such cross-pollination is difficult to prevent. However, only apparently pure seeds were used in the tests. After every fourth or fifth or sixth variety, Calamba Yellow Flint was planted as check to reveal any variation due to soil. There were in all eight check plots. The check variety was tested the same as the other varieties. All the plots received the same treatment. They were cultivated twice. The dates of germination, tasselling, silking, and maturity, were noted. Each variety was gathered separately in harvesting, and the ears weighed immediately after.

CALCULATION OF YIELD

In comparing the varieties with regard to yield, the yield per plant was taken as the basis, rather than the yield per hectare. Table II shows the method of yield computation.

The yields of the check plots showed that the land became richer from the right to the left, and consequently, the theoretical yields of the check should increase from the right to the left also. The difference between the two checks was divided by seven, which was the number of plots lying between the two checks. The result was the amount by which each theoretical yield increases from the left to the right, beginning from the lower yield of the check. The theoretical yields of the checks in plots occupied by non-check varieties were then compared with the corresponding actual yields of the varieties. The dif-

ferences were then combined algebraically with the average actual yield of the two checks. The last result represents the computed theoretical yield per plant of a variety.

RAINY SEASON CULTURES

During the progress of the rainy season culture, and when the grains were being formed, a storm occurred which lasted for several days. It affected the yield somewhat, especially of the late maturing varieties, by disturbing pollination and by breaking down some of the plants. However, since all the varieties were subjected to the same environment, the yields should be comparable. The theoretical yield of each variety was computed in the same way as for the dry season plantings.

The characters of the different varieties were also taken from ten average ears of each. These ears were dried thoroughly in the sun. In the case of Calamba Yellow Flint which was used as the check variety the samples were taken from all plots on which it was grown. The standard used in obtaining the ear characters was taken from Rundle's work on corn (2).

All foreign varieties, except Cuban Yellow Flint, have almost cylindrical ears, while the native varieties have tapering ears. Of all these varieties, Calamba Yellow Flint had the longest ear, measuring from 16 to 20 centimeters. Most of the native varieties, as Los Baños Yellow Flint, Lipa Yellow Flint, Colampus and others, had ears of small circumference, while most of the foreign varieties, as Mexican June, Boone County White, and others, had ears of medium circumference. There were only five native strains that had a medium circumference and four foreign varieties that had a small circumference.

The number of rows of kernels was variable, varying from less than 14 to 20. Eleven of the native varieties had a medium number of rows, while there were only nine of the foreign varieties which had this characteristic. Only Guam White Flint had a very poor arrangement of rows, there being a considerable width between every other row. All of the varieties had exposed tips. The chief characteristic of the native corn was, on the average, the enlarged butt.

The size of the shank appeared to have some relation to the position of the ear at maturity. The ears that had large shanks as the Cuban Yellow Flint, Los Baños White Flint, Lamao Moro, and Guam White Flint, did not hang down while those that had small shanks generally did. In nearly all foreign varieties, the ears hung down at maturity, while in most native strains, they did not.

The size of the cob was apparently correlated with the length of the kernel. Varieties with the smaller cob had medium grains. All foreign varieties had smaller cobs and longer grains than the native. Los Baños White Flint and Guam White Flint had large cobs and shallow grains. All the native varieties used are flint corns, while the foreign varieties used are all dent corns, except Cuban Yellow Flint.

From the results of the rainy season cultures it appears that the following can be deduced:

There was a slight difference between the native and foreign varieties in the date of germination. It took the native varieties from three to four days

to germinate; the foreign varieties from three to five days. Wisconsin White Dent and Henry Grady, both germinated on the fifth day.

The length of the growing season varied from 90 to 98 days; with the foreign varieties from 90 to 97; the native from 90 to 98 days. In general, the native varieties matured later than the foreign varieties. Wisconsin White Dent and Lipa Yellow Flint were the earliest maturing strains having 90 days for their growing season; Yellow Dent and Davao Early Flint with 91 days were recorded. The third earliest variety was Leyte White Flint, maturing within 92 days. There were in all, five early maturing varieties; these matured in from 90 to 92 days. There were ten medium, maturing in from 93 to 95 days, and 18 late maturing from 96 to 98 days.

As to height, Lamao Moro was the tallest variety, measuring 274.83 centimeters on the average. Los Baños Yellow Flint produced plants 272.2 centimeters high. Among the foreign varieties, Mexican June was the highest, but stood only fourth in the cultures. In general, the tall strains were late strains, while the short strains as Davao Early Flint, Leyte White Flint, Cuban Yellow Flint, and others, were early maturing strains.

The foreign varieties had the highest percentage of sterile plants. This may be because they are not yet acclimatized to the place. Jackson Red Cob led with 81.66 per cent; Shaw's Improved came second with 80.06 per cent; Bolero, third, with 54.82 per cent; and Lipa Yellow Flint had the lowest with 6.06 per cent; then Sto. Tomas Yellow Flint with 8.53 per cent; Alexander's Prolific with 9.95 per cent. The varieties that had the highest percentage of sterile plants were late maturing, while those having the lowest were early maturing.

When the different varieties were ranked according to the yield per plant, the results were as shown in Table III.

The best varieties, as Calamba Yellow Flint, Sto. Tomas Yellow Flint, and Los Baños Yellow Flint, were medium in length of growing season and in the height of plants. They had, also, low percentage of sterile plants.

The heaviest yielder had generally high but not the highest shelling percentage. This varied from 85 to 87 per cent. Davao Early Flint which ranked 16, had the highest shelling percentage, 88.11, and Mimis, which ranked 19, had the second highest shelling percentage, 87.98.

DRY SEASON CULTURES

As the plantings in this work were such as to permit cross-breeding, the harvests were, consequently, most probably hybrids. This fact should be borne in mind in studying the results of the seeds which were obtained from the rainy season cultures.

The land used had been cultivated in past years but had been lying idle for some time before the College acquired it in 1919. The same procedure was followed throughout in these cultures as with the rainy season cultures. The characteristics of the crop were just the same as with those of the rainy season crop.

From the results of the dry season tests, it appears that the dry season cultures had a longer growing season than the rainy season cultures. Davao Early Flint had the shortest growing season, 100 days; Wisconsin White Dent, Leyte

White Flint and Lipa White Flint, came second with 103 days; and Colampus third with 106 days. This difference in the growing season was due mainly to the climate.

The plants in these cultures were shorter than those of the rainy season cultures. Hildreth was the tallest, measuring 230.16 centimeters, which is 44.67 centimeters less than the tallest of the rainy season cultures. Jackson Red Cob was second, measuring 218.8 centimeters. The tall varieties were late in maturing, while the short varieties were early.

The percentage of sterile plants in these cultures was lower than in the rainy season cultures. This showed that as the plants become more acclimatized, the percentage of sterility becomes lower. Jackson Red Cob had the highest, 20.03 per cent; Weimas Yellow Dent second with 18.71 per cent; and Boone County White third with 13.94 per cent.

The native varieties had the highest shelling percentage, 86.77 for Davao Early Flint and 86.56 per cent for Mimis. The ranking of the different varieties in yield per plant from the results of dry season tests is shown in Table IV.

The heaviest yielders in the rainy season were not necessarily the best producers in the dry season. There is a good variety for each season. The foreign varieties were the best producers in the dry season. Shaw's Improved was the best with a yield of 131.77 grams per plant; Malboro Zears, second with 130.91 grams; and Mosby, third, with 128.61 grams. Among these varieties, Mexican June was the only one which was good in both seasons. It ranked fourth and fifth in the rainy and dry season cultures, respectively.

It must be remembered that cross fertilization could not be avoided in this experiment. The seeds used in the dry season cultures were more or less hybrids and crosses, and this had a decided effect on these cultures.

It was found out by Mendiola (3) that in planting different varieties of corn near one another and allowing them to cross-breed, new varieties which are superior to either parent can be obtained. As stated in the first part of this paper, the different varieties and strains were planted side by side so that crossing took place. Of course, the amount of crossing would not be the same throughout; at the same time, it is to be assumed that new strains or varieties were formed. The yield of the first generation of these hybrids and crosses might have been greater than either parent. The foreign varieties, not being as well acclimatized on the College farm as the native ones, might have been of the two more benefited by the effect of crossing. This may, explain in part, why the best varieties in the rainy season were not the best in the dry season.

SUMMARY OF CONCLUSIONS

1. The foreign varieties had almost cylindrical ears, while the native had tapering ears.
2. Calamba Yellow Flint had the longest ears.
3. Most of the native varieties had ears of small circumference.
4. All the varieties had exposed tips.
5. The native corns had enlarged butts.
6. The size of the shank had some relation to the position of the ears at maturity. Those that had big shanks did not hang down at maturity, while those with small shanks did.

7. The size of the cob was apparently related to the depth of the kernel. Smaller cobs had longer kernels than large cobs.

8. In the length of the growing season, the rainy season cultures varied from 90 to 98 days; while the dry season cultures varied from 100 to 119 days.

9. The plants of the dry season cultures were shorter than those of the rainy season cultures.

10. The tall strains of varieties were late maturing, while the short varieties were early.

11. The foreign varieties had the largest percentage of sterile plants.

12. The best yielders in the rainy season were not always the heaviest producers in the dry season. Calamba Yellow Flint was the heaviest yielder in the rainy season cultures, while Shaw's Improved was the best in the dry season cultures.

13. The heaviest yielders had generally high, but not the highest, shelling percentage.

ACKNOWLEDGMENT

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TABLE I.—*Giving varieties and strains used in this work.*

Number.	College number.	Name of variety.	Date of introduction.	By whom introduced.	From where introduced.	Generation of seed in College.	Kind of crop.
1	9200	Weimas Yellow Dent	May 31 1918	W. H. Weston	Honolulu, Hawaii	F_1	Rainy
2	357	Mexican June					Dry
3	5963	Boone County White	July 10, 1916		Missouri Agr. Expt. Station	F_3	Rainy
4	6141	Wsconsin White Dent	Sept. 13, 1916	Morse		F_3	Rainy
5	5934	Florida Flint	July 5, 1916		Alabama Expt. Station	F_3	Rainy
6	5932	Henry Grady	July 5, 1916		Alabama Expt. Station	F_3	Rainy
7	5930	Mosby	July 5, 1916		Georgia Expt. Station	F_3	Rainy
8	5929	Shaw's Improved	July 5, 1916		Alabama Expt. Station	F_3	Rainy
9	5928	Malboro Zears	July 5, 1916		Alabama Expt. Station	F_3	Rainy
10	5877	Freed's White Dent	June 12, 1916		Kansas Sta. Agr. College	F_3	Rainy
11	5874	Hildreht	June 12, 1916		Kansas Sta. Agr. College	F_3	Rainy
12	4926	White Pearl	Nov. 15, 1915		Germain Seed & Plant Co.	F_3	Rainy
13	5931	Alexander's Prolific	July 5, 1916		Alabama Expt. Station	F_3	Rainy
14	5935	Jackson Red Cob	July 5, 1916		Alabama Expt. Station	F_3	Rainy
15	5881	Kansas Sunflower	June 12, 1916		Kansas State Agr. College	F_3	Rainy
16	9201	Cuban Yellow Flint	May 31, 1918	W. H. Weston	Honolulu, Hawaii	F_1	Rainy
17	9176	Calamba Yellow Flint	May 20, 1918	Antonio Chanco	Calamba, Laguna	F_2	Dry
18	6787	Davao Early Flint	July 11, 1917	W. H. Weston	Glan Colony, Cotabato, Mindanao	F_2	Dry
19	11108	Sto. Tomas Yellow Flint	May 10, 1919	Emilio K. Morada	Sto. Tomas, Batangas		Dry
20	11109	Los Baños Yellow Flint	May 10, 1919	Emilio K. Morada	Los Baños, Laguna		Rainy
21	11107	Lipa Yellow Flint	May 10, 1919	Emilio K. Morada	Lipa, Batangas		Dry
22	4434	Montellano's Yellow Flint	July 7, 1915	Pedro Montellano	Los Baños, Laguna	F_5	Dry
23	7732	Cebu Yellow Flint	October 3, 1917	Antonio Derecho	Cebu, Cebu	F_1	Rainy
24	9360	Leyte White Flint			Baraun, Leyte	F_1	Dry
25	11110	Los Baños White Flint	May 10, 1919	Emilio K. Morada	Los Baños, Laguna		Rainy
26	9440	Lamao Moro	June 11, 1918		Lamao, Bataan	F_2	Dry
27	9203	Guam White Flint	May 31, 1918	W. H. Weston	Honolulu, Hawaii	F_1	Rainy
28	9202	White Guam	May 31, 1918	W. H. Weston	Honolulu, Hawaii	F_1	Rainy
29	7731	Cebu White Flint	October 13, 1917	Antonio Derecho	Cebu, Cebu,	F_1	Rainy
30	4349	Bolero	May 31, 1915	Judge M. Cui	Cebu, Cebu	F_4	Rainy
31	4352	Mimis	May 31, 1915	Judge M. Cui	Cebu, Cebu	F_4	Raniy
32	4351	Colampus	May 31, 1915	Judge M. Cui	Cebu, Cebu	F_4	Rainy

TABLE II.—*Showing method of yield computation.*

Name of variety.	Actual yield per plant.	Theoretical yield per plant of check.	Difference between check and variety.	Computed yield.
	gm.	*gm.*	*gm.*	*gm.*
Check	90.52	—	—	—
Weimas Yellow Dent	24.29	86.75	—62.46	15.04
Mexican June	71.67	83.04	—11.37	66.13
Boone County White	32.86	79.33	—46.47	31.03
Wisconsin White Dent	43.93	75.62	—31.69	45.81
Florida Flint	43.75	71.91	—28.16	49.34
Henry Grady	10.69	68.20	—57.51	19.99
Check	64.49	—	—	—

TABLE III.—*Showing relative rank, based on yield of ears of rainy season cultures.*

Rank.	College number.	Name of Variety.	Computed yield of ears per plant.	Computed yield of shelled corn per plant.
			gm.	gm.
1	9176	Calamba Yellow Flint	92.79	79.24
2	11108	Sto. Tomas Yellow Flint	81.46	71.33
3	11107	Lipa Yellow Flint	66.78	58.41
4	357	Mexican June	66.13	56.65
5	11109	Los Baños Yellow Flint	63.34	55.35
6	4434	Montellano's Yellow Flint	57.29	49.76
7	9202	White Guam	56.72	49.33
8	7732	Cebu Yellow Flint	51.01	43.90
9	7731	Cebu White Flint	50.11	42.73
10	5934	Florida Flint	49.34	42.30
11	9203	Guam White Flint	47.92	39.34
12	6141	Wisconsin White Dent	45.81	36.67
13	4351	Colampus	45.48	39.19
14	11110	Los Baños White Flint	44.06	35.73
15	5931	Alexander's Prolific	42.99	36.35
16	6787	Davao Early Flint	36.24	31.93
17	5877	Freed's White Dent	35.23	29.05
18	5881	Kansas Sunflower	34.57	29.54
19	4352	Mimis	31.81	27.99
20	4926	White Pearl	31.39	26.36
21	5963	Boone County White	31.03	26.39
22	9440	Lamao Moro	26.52	21.13
23	9360	Leyte White Flint	22.58	17.10
24	5932	Henry Grady	19.99	14.15
25	5930	Mosby	19.91	16.75
26	4349	Bolero	18.91	16.18
27	9200	Weimas Yellow Dent	15.04	12.08
28	5928	Malboro Zears	14.14	11.71
29	9201	Cuban Yellow Flint	12.72	9.14
30	5929	Shaw's Improved	10.17	8.20
31	5935	Jackson Red Cob	7.84	6.38
32	5874	Hildreht	7.38	6.00

TABLE IV.—*Showing relative rank, based on yield of ears of dry season cultures.*

Rank.	College number	Name of variety.	Computed yield of ears per plant	Computed yield of shelled corn per plant.
			gm.	gm.
1	5929	Shaw's Improved	131.77	106.17
2	5928	Malboro Zears	130.91	105.29
3	5930	Mosby	128.61	104.17
4	4926	White Pearl	112.94	93.93
5	357	Mexican June	108.96	91.88
6	4352	Mimis	104.72	90.65
7	9440	Lamao Moro	104.18	79.70
8	9203	Guam White Flint	102.52	80.28
9	6141	Wisconsin White Dent	101.35	83.75
10	4351	Colampus	101.29	85.37
11	11110	Los Baños White Flint	99.21	76.02
12	5932	Henry Grady	97.67	79.13
13	9176	Calamba Yellow Fluit	97.30	80.17
14	11109	Los Baños Yellow Flint	96.30	78.95
15	5874	Hildreht	94.35	76.98
16	4349	Bolero	94.25	79.31
17	5877	Freed's White Dent	92.87	75.65
18	11108	Sto. Tomas Yellow Flint	91.97	77.67
19	9202	White Guam	91.77	78.01
20	7731	Cebu White Flint	88.89	74.77
21	4434	Montellano's Yellow Flint	86.86	72.56
22	9200	Weimas Yellow Dent	86.06	72.26
23	5934	Florida Flint	84.33	68.58
24	5881	Kansas Sunflower	82.77	68.29
25	7732	Cebu Yellow Flint	81.40	67.68
26	5935	Jackson Red Cob	81.31	64.69
27	11107	Lipa Yellow Flint	75.83	64.48
28	5931	Alexander's Prolific	74.08	62.15
29	5963	Boone County White	74.00	60.69
30	9201	Cuban Yellow Flint	68.48	52.15
31	9360	Leyte White Flint	67.24	53.10
32	6787	Davao Early Flint	61.53	53.30

DISTRIBUTION OF ABACA IN CAVITE PROVINCE AS RELATED TO SOIL AND CLIMATE[1]

By Pedro S. Rojales

Abaca growing is almost exclusively a Philippine industry as the attempts to grow it in other tropical countries have met with but little success (1). Its fiber as an article of commerce is widely known and extensively used in the manufacture of cordages, clothing, etc. So if there is any way possible to determine the most suitable soil and climatic conditions and to further extend the growing region of this crop in the Islands, it should be done so the abaca industry would increase and the Filipinos enjoy greater prosperity.

With this idea of extension in mind, the work discussed in this paper was undertaken; the work was to study the distribution of abaca in Cavite Province and what conditions determine its distribution in different parts of the province.

The distribution of abaca depends upon three sets of conditions: climate, soil conditions, and the presence or absence of its pests or enemies. Places where abaca is successfully grown should have the proper combination of the first two of these conditions and the complete absence of its enemies. The most favorable localities are along the eastern and southern coasts of the Islands. It may be cultivated up to a maximum altitude of 1200 meters above the sea level. Above this altitude the temperature may not be favorable. A large part of the archipelago is favorable for abaca cultivation. The important abaca provinces are: Leyte, Albay, Sorsogon, Ambos Camarines, Samar, Davao, Surigao, Misamis, Oriental Negros, Cavite. Abaca is grown to some extent in some other provinces and on many small islands. The method of cultivation and stripping are about the same in the different abaca regions of the archipelago.

According to tabulated data furnished by the Bureau of Agriculture, Cavite ranked tenth in quantity of fiber produced in 1919, but in the classification of the quality of the fibers, Cavite ranked first (2).

RELATION OF DISTRIBUTION OF ABACA TO CLIMATIC CONDITIONS

The climate is the first and most important requisite for successful abaca cultivation. Therefore the relation of climate to abaca is very significant. The Philippines, although a tropical country, possesses different climatic conditions in different parts. Father Algue (3) of the Weather Bureau classified the climate in the Philippines into three types, as follows:

FIRST TYPE

Rainfall
- Heaviest: November, December, January, February.
- Medium: July, August, September, October.
- Lightest: March, April, May, June.
- Total yearly: 2766 mm.
- No dry season.

Humidity: Small range of humidity, 78-88 per cent.

Temperature: Averages less than 27°C.

[1]Thesis presented for graduation from the College of Agriculture No. 120; Experiment Station contribution, No. 49.

SECOND TYPE

Rainfall
- Heaviest: June, July, August, September, October.
- Medium: November, December, April, May.
- Lightest: January, February, March.
- Total yearly: 2453 mm.
- Very distinct wet and dry seasons.
- (Dry season lasts from five to six months.)

Humidity: Large range, 70-86 per cent.
Temperature: Around 27° C.

THIRD TYPE

Rainfall
- Heaviest: July, August, September, October, November.
- Medium: May, June, December, January.
- Lightest: February, March, April.
- Total yearly: 1856 mm.
- Short period of dry season: January, April.
- (Dry season lasts from one to two months.)

Humidity: Very small range.
Temperature: Around 26° C.

This wide range of climate with such variety in distribution of rainfall in different parts of the archipelago favors the large number of important agricultural products which may be obtained in the Islands. It is possible to get practically all tropical products in the same region by artificial means, such as irrigation and shading. Of the three types of climates described, the first is the most favorable for the growth and development of abaca. This is the type of climate in the great abaca regions, Albay, Ambos Camarines, eastern coasts of Samar, Leyte, and Mindanao, and the northern coast of Mindanao. Some places, as the uplands of Cavite, Mindoro, Negros, etc., with the second or third type of climate can grow abaca successfully. In these places shading is practiced. Cavite (upland region) which is classified as in the second type can grow abaca successfully, probably because of the high altitude and hence the low temperature and high humidity; the success may also be due to proper management and the variety used. The north sides of Indang and Silang (upland Cavite municipalities) are low and have a high temperature; here abaca can not be grown except during the wet season. When the dry season comes the plants dry up and die.

Father Algue of the Weather Bureau in an address at the College of Agriculture stated that the amount of rainfall per month favorable to abaca cultivation is 80 millimeters. This is rather low and he did not say whether or not this rainfall is uniform, or on a week basis; there is no published record of this. Table I was compiled with 80 millimeters a month as a basis.

The total amount of rainfall a year in each region shows that Paracale, Ambos Camarines, has the greatest amount, 4825 millimeters; the next is Borongan, Samar, with 4177.66 millimeters; then Legaspi, Albay, with 3572.94 millimeters; then Atimonan, Tayabas, with 3344.48 millimeters; Silang, Santa Cruz, and Cotabato have almost the same total amount of rainfall 1920.56, 1900.12, and 1890.70 millimeters, respectively. The average rainfall in all the

abaca producing regions mentioned is shown in the last column of Table II. Silang, Cavite, has considerably less rainfall than the average amount for all of the abaca producing localities cited.

TABLE I.—*Rainfall in the different abaca growing sections.*

Sufficient in all months.	Atimonan, Tayabas; Boroñgan. Samar; Butuan, Surigao; Calbayog, Samar; Gubat, Sorsogon; Legaspi, Albay; Paracale, Ambos Camarines; Surigao, Surigao; Tacloban, Leyte.
Deficient in one month.	Davao, Davao.
Deficient in two months.	Dumaguete, Negros; Capiz, Capiz.
Deficient in three months.	Calapan, Mindoro.
Deficient in four months.	Zamboanga, Mindanao.
Deficient in six months.	Silang, Cavite.

In Table II comparisons of temperature are shown between the province of Cavite and the two provinces which produce the greatest amount of abaca.

TABLE II.—*Comparison of temperature of Leyte, Albay, and Cavite.*

Provinces.	Mean maximum.	Mean minimum.	Average mean, $\frac{\text{Max.} + \text{Min.}}{2}$
	°C.	°C.	°C.
Leyte	29.9 — 32.8	21.7 — 24.2	27.2
Albay	29.8 — 33.7	21.6 — 24.7	27.5
Cavite	29.4 — 31.8	18.3 — 20.05	24.9

The ranges of mean maximum temperatures, mean minimum temperatures, and the average mean temperature of Cavite are lower than the maximum, minimum, or average mean of either Leyte or Albay. This is probably due to altitude. Cavite, being higher than either Albay or Leyte, has a lower temperature, as shown in Table II. Therefore, although Cavite has a long dry season of six months' duration, the temperature is lower and consequently the humidity is higher.

For these reasons evaporation from the soil and transpiration from the abaca plants are probably less severe in their effects upon the plant than in the other localities with the same duration of dry season, but with higher temperature. Most of the abaca in Cavite is grown at the higher elevations, and therefore in the cooler and more humid localities.

The abaca region of Cavite has a drier climate, with a longer dry season, than most abaca-producing localities, but it also has a lower temperature, and consequently higher humidity and lower evaporation, which tends to counteract the dryness of the climate.

PLAN OF PRESENT STUDY

During summer of 1919 the different abaca growing sections in the province of Cavite were investigated and thoroughly studied. The study was made along the following lines: History of abaca in Cavite; the geographical distribution of abaca; climatic conditions; and the condition of the places where abaca grows well and places where it does not grow well. Soil samples were taken from different places: (a) where abaca grows best or most vigorously; (b) where abaca grows moderately well; (c) where abaca grows wery poorly; and (d) where abaca can not be grown. The practices during dry season to maintain soil moisture and the varieties of abaca grown in different places were also thoroughly studied.

HISTORY OF ABACA IN CAVITE

Information about the history of the industry was obtained from several old men in the town of Amadeo, Cavite, which is supposed to have been the first place in the province where abaca was grown. These men say that the first abaca grown in this province was from Albay Province. A man by the name of Juan Manzano who escaped from death in the eruption of Mayon Volcano about 1814 reached the barrio of Masilao, now the town of Amadeo. He married in that place and soon after he returned to Albay on a visit. As he knew that abaca was used in Albay for making rope, he brought back with him to Masilao four suckers of this plant. He planted them and as the place is favorable for the growth of the plant, they grew luxuriantly, and from them a large plantation was developed. Many people around the barrio began to grow abaca because they could tie their carabaos and cows with the rope made of the fiber, instead of with vines. This important plant was distributed and was introduced into Mendez Nuñez, then into Alfonso, and later into Indang and Silang. All of these towns are in the province of Cavite. Later the people found out that the fiber could be used not only for making rope but also for making sinamay[2]. To honor the man who introduced this important industry in Amadeo, every year the people set aside a day for a fiesta called *quinraray*, a Bicol word, meaning fibers for weaving.

DISTRIBUTION OF ABACA IN THE PROVINCE

Abaca is distributed throughout the uplands of the province of Cavite. It is successfully grown in approximately one third of the whole province. This area lies along the sloping sides toward the north of Tagaytay mountain, occupying the towns of Indang and Silang; the higher the elevation the more luxuriantly the abaca grows.

The area and production of abaca in these towns for three successive years are shown in Table III.

Variations of area and production every year are shown in Table III. These are, however, rough calculations for each municipality based upon information obtained by the writer. There were no exact data recorded by any of the municipal secretaries.

These calculations are not satisfactory. During the investigation, the writer estimated that Mendez and Amadeo were about equal in production yet the tabulated production places Amadeo far ahead.

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[2] Sinamay is a cloth made of the fine fibers of abaca.

TABLE III.—*Area and production of abaca in the towns of Amadeo, Alfonso, Mendez, Indang, and Silang.*

Name of the town.	1916		1917		1918	
	Area.	Production.	Area.	Production.	Area.	Production.
	hectares	*piculs*	*hectares*	*piculs*	*hectares*	*piculs*
Amadeo	10,000	315	12,000	1,735	15,510	73,240
Alfonso	1,200	1,904.4	1,220	2,031.7	1,220	2,031.7
Mendez	1,500	2,085.7	1,500	3,892.7	2,000	2,412
Indang	715	419.4	792	707.7	822	2,412
Silang	2,050	3,695	2,350	3,860	2,500	4,110

VARIETIES OF ABACA GROWN IN CAVITE

There are only two local varieties known by the abaca growers, Sinibuyas and Kinalabao. They are very different from each other. Sinibuyas is a variety usually grown in level places, while the Kinalabao is grown on the sides of a creek where there is plenty of water. Sinibuyas is the smaller variety; the stalk grows only from two to four meters tall. The color of the stalk is light green with pinkish lining. The fibers are strong, white, and fine. This variety is easy to strip. The variety Kinalabao grows to a maximum height of five and a half meters, and develops a stalk with a diameter of from 15 to 30 centimeters. The color of the stem is dark green. The fibers are coarse, sometimes brittle and hard to strip.

CLIMATIC CONDITIONS

RAINFALL

The rainfall in the province of Cavite seems to be abundant especially in the months of May, June, July, August, September, and October. The rain in the other months is less, especially in the months of February, March, and April. The distribution is variable, however, but due to lack of observations no data were available except for the town of Silang.

TEMPERATURE

The temperature of Silang is variable and the mean temperature averages from 23° to 25°C., throughout the year. This place is the dividing line where abaca begins to be successfully cultivated. Since the upland region of Cavite is sloping the temperature must become lower as the elevation gets higher. Since there was no weather observation in Amadeo, Mendez Nuñez, Alfonso, and Indang, no data can be given here, but the temperature in Indang, especially in the dry season, is very high and causes the drying of the abaca, so farmers put up more shades when this season is on to prevent drying. They also cultivate the soil for mulch.

WINDS AND TYPHOONS

A hard wind or a typhoon which strips and tears the leaves of the plant is detrimental to abaca. The wind is severe on the Tagaytay ranges due to the

prevailing wind from the northeast. Efforts are made to build wind-breaks, that is, by planting shade trees before planting abaca. Abaca planted in places where wind-breaks are not used is destroyed and retarded in its development. Many farmers have observed this and now they are meeting the situation by planting wind-breaks.

ELEVATION

The elevation has much to do with the cultivation of abaca. As the uplands of Cavite are sloping, the elevation is variable. It has been learned that from the towns of Indang and Silang, the border line where the abaca cultivation begins, the crop becomes better as the elevation becomes higher. This is because the humidity increases as the temperature decreases.

The following tabulation shows the different altitudes[3] of the places in the abaca growing section of Cavite.

NAME OF THE PLACE	ALTITUDE IN METERS
Alfonso	399.80
Amadeo	408.43
Indang	292.61
Mendez	487.68
Silang	317.99
Tagaytay	640.08

According to information the altitudes were taken only in the middle part of each station and therefore they will not hold throughout the towns for the upland section of Cavite is sloping.

STUDY OF ABACA SOILS

Soil samples were collected from different localities under the following conditions: (See Tables IV to VIII column 1).

I. Where abaca can not be grown.
II. Where abaca grows very poorly.
III. Where abaca grows moderately well.
IV. Where abaca grows best or most vigorously.

These samples were taken by digging with a grub-hoe to a depth between 10 and 30 centimeters, and on the sides of the clean cut soil samples were taken and put in air-tight cans at once to prevent evaporation of moisture. The date when the samples were taken, the date when the last rain had occurred, and the production of fiber per year in each place were recorded. The samples were brought to the College for determination of:

1. The moisture content.
2. Water-holding capacity.
3. Shrinkage.
4. Weight per liter of dry soil.
5. Organic matter.

DETERMINATION OF MOISTURE CONTENT

The moisture content was determined of each sample by first weighing the sample and then drying it in the oven until constant weight was reached. From these data the per cent of moisture content was determined.

[3] Altitudes were calculated by the District Engineer of Cavite.

WATER-HOLDING CAPACITY

The water-holding capacity of the soil was determined in order to find its relation to the production of the fiber. Two methods were used for the determination, drainage, and absorption. The soil was pulverized and one centimeter deep perforated-bottom pans were filled.[4] Then they were saturated with water and allowed to drain for 24 hours. The pans were weighed and then dried in the oven until constant weight was reached. From the data was determined the per cent of water on the dry weight retained after 24 hours (the so-called water-holding capacity). The other method, absorption, was used to check the former and was determined in the reverse order. The same pans used in the first method were filled with pulverized soil and dried till the constant weight was reached. Then they were put over the water and allowed to absorb water for 24 hours. At the end of this time, they were weighed and from the data was determined the water-holding capacity of the soil. During these determinations the shrinkage of the soil as well as the weight per liter of dry soil were also determined.

ORGANIC MATTER

The organic matter was determined from the total amount of carbon dioxide in the soil. That is, the organic and inorganic carbon dioxide were first found by combustion method with concentrated sulphuric acid. Then the inorganic carbon dioxide was determined alone by one-tenth diluted hydrocloric acid and then by subtracting this from the total carbon dioxide, organic carbon was left. According to Willey, "From the organic carbon contained in the soil, the organic matter is calculated on the supposition that it contains 58 per cent of carbon. It is therefore only necessary to multiply the percentage of carbon found by 1.724 or the carbon dioxide formed by 0.471 to determine the quantity of humus in dried soil." (4).

Tables IV, V, VI, VII, and VIII show the results obtained.

The soil is second in importance to favorable climatic conditions in the successful production of abaca. The production must depend on the relative condition of the climate, that is, abaca may be produced on a poor soil provided that the climatic condition is favorable but the richer the soil the more the production obtained. As shown in the Tables IV, V, VI, VII, and VIII, the higher the percentage of organic matter the more the production. This is due, probably, to the fact that organic matter serves not only as food material for the plants, but also, as a storage of moisture, a requirement which is essential to abaca especially during drought or dry season. Hence, the soil to be selected must be rich in organic matter, principally.

The moisture content of the soil as determined was found to vary directly with the abaca production. As the production increases, the moisture content also increases. The higher moisture content of the better soil is probably due to increase of organic mater. Since the soil sample was taken during the dry season it was assumed that the per cent found was near the minimum for the maintenance of abaca. The abaca plants were drying at the time the samples

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4 Hilgard, E. W. Soils, their formation, properties, composition, and relation to climate and plant growth in the humid and arid region, p. 209. 1914.

were taken. A basis of comparison of relative amount of water which plants can obtain from the different soils may be found by dividing the per cent by weight of moisture content by the per cent of water-retaining capacity times 100 (5).

TABLE IX.—*Water content of abaca soils in terms of percentages of the water-retaining capacity.*

No. of Sample.	Indang.	Silang.	Mendez.	Amadeo.	Alfonso.
	per cent	*per cent*	*per cent*	*per cent*	*per cent*
I	41	50	——	——	——
II	34	59	72	69	40
III	41	65	61	84	40
IV	38	58	64	75	38

We see from the presentation of the data in Table IX that there is no relation of this index to the production of abaca. The climatic conditions and care of the plantation are probably responsible for the variations in the amount of water the soil holds during the dry season. Briggs and Shantz (5) show that the water-retaining capacity is proportional to the wilting coefficient of most soils. Therefore, the ratio between the actual water content and the water-retaining capacity of the soil is a satisfactory index of the amount of water in the soil actually available for plants.

SHRINKAGE AND WEIGHT OF DRY SOIL

The shrinkage of the soil was about fifty per cent during the drainage of the soil after saturation with water. The weight per liter of dry soil ran from 504 to 640 grams, throughout. (See Tables IV, V, VI, VII, VIII.)

SUMMARY AND CONCLUSIONS

1. The abaca growing section of Cavite is sloping and the success of cultivation varies with altitude and exposure. The localities in which abaca grows successfully in order of their importance and altitudes, the best and highest first, are: Amadeo, Mendez Nuñez, Alfonso, Silang, and Indang.

2. The rainfall in the province of Cavite is abundant during the months of May, June, July, August, September, and October. The other months have little rain, especially in the months of February, March, and April, and constitute a distinct dry season. The total amount of rainfall is 1920.56 millimeters while in the best abaca growing section in the Islands, Leyte, the Weather Bureau station shows 2,569.73 millimeters and it is uniformly distributed throughout the year. Samar has the greatest amount of rainfall. Its Weather Bureau station, Borongan, shows 4,177.66 millimeters. The long deficiency in favorable amount of rainfall in Silang and Indang affects the abaca production in those towns. The growers allow more shade and cultivate more during the dry season than during the wet season so as to prevent too much loss of water.

3. The temperature of Silang is lower than the temperature in other good abaca growing sections although they have more rainfall.

4. Hard winds or typhoons are very detrimental to abaca plants. The practice in Cavite is to plant trees as wind-breaks. To this excellent practice may be added the use of wind-resistant varieties.

5. Organic matter in the soil appears to be directly related to the production of abaca. The richer the soil in organic matter the more production of fiber there will be according to observations made in Cavite.

7. The shrinkage of abaca soil in Cavite is about 50 per cent. The weight per liter of dry soil is from 504.44 grams to 640 grams.

8. There are only two distinct varieties of abaca grown in Cavite: Sinibuyas and Kinalabao. Sinibuyas seems to be more resistant to drought than Kinalabao, other things being equal.

ACKNOWLEDGMENT

The writer is indebted to Prof. F. T. McLean under whom this work was done, for his advice and criticism during the progress of the work, and to Prof. F. W. Ashton for his help in the determination of organic matter in the soil. Thanks are also due the District Engineer of Cavite who helped the writer to find the altitudes of the different localities in the uplands of Cavite, and to the secretaries of the municipalities in Cavite who helped to secure the statistical data of the area and yearly production of abaca.

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(4) Willey, H. W. Principles and practice of agricultural analysis. Soils **1**: 1906.

(5) Briggs, L. W., and Shantz, H. L. The wilting coefficient on different plants and its indirect determination. U. S. Bureau of Plant Industry Bulletin 230: 1912.

TABLE IV—*Analysis of abaca soil in Alfonso.*

Sample number.[a]	Date when sample was taken.	Date of last rain.	Production of fiber per ha. per year.	Moisture content.		Water-holding capacity.		Shrinkage.			Weight per liter of dry soil.	Organic matter.	
				In each sample.	Average.	By drainage method. Water held in 24 hours 1 cm. deep.	By absorption method. Water absorbed.	Original height.	Shrinkage in drying.	Shrinkage.		Organic CO_2	Calculated organic matter
			piculs	*per cent*	*per cent*	*per cent*	*per cent*	*cm.*	*cm.*	*per cent*	*gm.*	*per cent*	*per cent*
II	4-28-19	Had not rained since the beginning of February, 1919.	2.905	14.05 13.95	14.00	34.06	36.15	1	.475	47.5	520.61	1.47	.692
III	4-28-19		3.636	18.15 18.63	18.39	46.30	46.00	1	.475	47.5	519.61	1.68	.791
IV	4-28-19		6.363	20.65 20.53	20.59	53.30	55.02	1	.50	50.0	552.02	2.12	.998

[a] There is no sample I because abaca grows in all places in the municipality.
Sample II was taken in the north about two kilometers from the municipal capital.
Sample III was taken in the north about one kilometer from the municipal capital.
Sample IV was taken in the south about one kilometer from the municipal capital.

TABLE V.—*Analysis of abaca soil in Amadeo.*

Sample Number.[a]	Date when sample was taken.	Date of last rain.	Production of fiber per ha. per year.	Moisture content.		Water-holding capacity.		Shrinkage.			Weight per liter of dry soil.	Organic matter.	
				In each sample.	Average.	By drainage method. Water held in 24 hours 1 cm. deep.	By absorption method. Water absorbed.	Original height.	Shrinkage in drying.	Shrinkage.		Organic CO_2.	Calculated organic matter.
			piculs	*per cent*	*per cent*	*per cent*	*per cent*	*cm.*	*cm.*	*per cent*	*gm.*	*per cent*	*per cent*
II	4-18-19	4-11-19 hard.	1.0055	26.24 26.46	26.35	36.9	41.12	1	.45	45.0	513.91	1.33	.626
III	4-18-19	4-11-19 hard.	5.50	39.07 39.14	39.11	46.24	47.16	1	.50	50.0	448.08	1.75	.824
IV	4-18-19	4-11-19	7.603	44.70 44.89	44.78	57.74	61.57	1	.55	55.0	528.92	2.33	1.097

[a] There is no sample I because abaca grows in all places in this municipality.
Sample II was taken in the northwest about one kilometer from the municipal capital.
Sample III was taken in the south side about half kilometer from the municipal capital.
Sample IV was taken in the south about two kilometers from the municipal capital.

TABLE VI.—*Analysis of abaca soil in Indang*

Sample number.[a]	Date when sample was taken.	Date of last rain.	Production of fiber per ha. per year.	Moisture content.		Water-holding capacity.		Shrinkage.			Weight per liter of dry soil.	Organic matter.	
				In each sample.	Average.	By drainage method. Water held in 24 hours 1 cm. deep.	By absorption method. Water absorbed.	Original height.	Shrinkage in drying.	Shrinkage.		Organic CO_2.	Calculated Organic matter.
			piculs	*per cent*	*per cent*	*per cent*	*per cent*	*cm.*	*cm.*	*per cent*	*gm.*	*per cent*	*per cent*
I	4-12-19	4-6-19 hard.	abaca dries in dry season.	20.47 20.54	20.5	49.08	50.1	1	.52	52.0	594.63	1.47	.692
II	4-12-19	4-6-19 hard.	1.500	23.67 25.21	24.44	72.18	73.0	1	.475	47.5	514.84	1.57	.739
III	4-13-19	4-6-19 not hard.	5.0	26.33 27.73	27.03	65.28	66.5	1	.50	50.0	504.44	1.68	.791
IV	4-13-19	4-6-19 not hard.	8.4	28.93 28.56	28.75	75.23	77.0	1	.50	50.0	596.72	2.35	1.106

[a] Sample I was taken in the barrio of Muson Calumpang about six kilometers north of the municipal capital.
Sample II was taken also in Calumpang about four kilometers north of the municipal capital.
Sample III was taken in the south about two kilometers from the municipal capital.
Sample IV was taken in the south about five kilometers from the municipal capital.

TABLE VII—*Analysis of abaca soil in Mendez Nuñez.*

Sample number.[a]	Date when sample was taken.	Date of last rain.	Production of fiber per ha. per year.	Moisture content.		Walter-holding capacity.		Shrinkage.			Weight per liter of dry soil.	Organic matter.	
				In each sample.	Average.	By drainage method. Water held in 24 hours 1 cm. deep.	By absorption method. Water absorbed.	Original height.	Shrinkage in drying.	Shrinkage.		Organic CO_2.	Calculated organic matter
			piculs	*per cent*	*per cent*	*per cent*	*per cent*	*cm.*	*cm.*	*per cent*	*gm.*	*per cent*	*per cent*
II	4-21-19	4-11-19 medium	4.08	25.26 25.42	25.34	33.85	56.15	1	.45	45.0	507.50	1.34	.631
III	4-21-19	4-11-19 medium	5.305	29.10 28.18	28.37	61.89	44.50	1	.50	50.0	640.95	1.46	.697
IV	4-21-19	4-11-19 medium	10.7445	39.40 37.27	38.37	61.89	57.39	1	.50	50.0	530.00	2.43	1.144

[a] There is no sample I because abaca grows in all places in this municipality.
Sample II was taken in the east side about one kilometer from the municipal capital.
Sample III was taken in the south-east about two kilometers from the municipal capital.
Sample IV was taken in the south about two kilometers from the municipal capital.

TABLE VIII.—*Analysis of abaca soil in Silang.*

Sample number.[a]	Date when Sample taken.	Date of last rain.	Production of fiber per hectare per year.	Moisture content.		Water-holding capacity.		Shrinkage.			Weight per liter of dry soil.	Organic matter.	
				In each sample.	Average.	By drainage method. Water held in 24 hours 1 cm. deep.	By absorption method. Water absorbed.	Original height.	Shrinkage in drying.	Shrinkage.		Organic CO_2.	Calculated organic matter.
			piculs	*per cent*	*per cent*	*per cent*	*per cent*	*cm.*	*cm.*	*per cent*	*gm.*	*per cent*	*per cent*
I	4-14-19	4-11-19 little	1.044	18.96 18.07	18.51	35.37	37.99	1	.45	45.0	613.00	1.23	.579
II	4-14-19	4-11-19 little	4.000	25.21 24.98	25.09	41.35	42.95	1	.525	52.5	508.09	1.57	.730
III	4-14-19	4-11-19 little	5.49	28.58 28.49	28.53	44.07	44.10	1	.475	47.5	508.90	1.86	.876
IV	4-14-19	4-11-19 little	6.00	29.89 30.08	29.98	50.75	52.00	1	.475	47.5	513.86	2.32	1.093

[a] Sample I was taken in the north about three kilometers from the municipal capital.
Sample II was taken in the north about one kilometer from the municipal capital.
Sample III was taken in the east side about one kilometer from the municipal capital.
Sample IV was taken in the south about one and a half kilometers from the municipal capital.

COLLEGE AND ALUMNI NOTES

On January 17 a party of eminent Netherlands officials from Java visited the College of Agriculture. The party was composed of the following: Mr. J. F. W. van der Meulen, assistant director of education; Father T. van Lith, Roman catholic missionary and headmaster of a private training college for native teachers; Mr. J. Groenema, supervisor of elementary schools; Mr. P. de Nes, supervisor of native schools; Mr. S. van der Veen, member of the board of education; Dr. G. J. Nieuwenhuis, member of the board of education; Dr. P. N. Degens, principal of a secondary school; Mr. H. Fieren, principal of a high school; Mr. R. A. Schotman, principal of a Dutch-Chinese school; Mr. A. M. Juten, supervisor of physical training; Dr. A. de Waart, principal of a medical school; Dr. L. S. A. M. von Romer, head of the medical propaganda; and Capt. H. Kieviet, of the Government steamer, *Orion*. In company with Mr. North Foreman of the Bureau of Education of the Philippine Islands and Mr. Emil Schneider of the Bureau of Forestry the group arrived at the College where they were received by the Dean, Professor Gonzalez, and Professor Higgins. They examined the laboratories, the cultures, the student quarters both of the College of Agriculture and the Forest School. Doctor Nieuwenhuis will remain in the Islands some weeks and will again visit the College to make a more detailed study of our student housing conditions.

Guy Potter Benton, A. M., D.D., LL. D., was elected president of the University of the Philippines at the meeting of the Board of Regents on March 7. Doctor Benton has held the presidency of several of the more prominent private colleges of America and of the University of Vermont. He was director of welfare work of the Y.M.C.A., in Paris during the early days of America's participation in the war, on the staff of Brig.-Gen. W. R. Sample. In 1918 he was selected by the military to be chief educational director of the army of occupation, holding under this jurisdiction perhaps the most unique educational administration ever attempted. The army schools had a faculty of two thousand, an enrollment of thirty-five thousand, and courses which included every thing from "the three Rs" to the more advanced university subjects. For his effective war work Doctor Benton was awarded the Distinguished Service Medal.

At the conclusion of the war Doctor Benton was elected vice-president of a bank in New York, a position which he surrendered to become educational adviser to the Philippine department of the United States Army. This service was well under way when he was elected president of the University of the Philippines. Doctor Benton is an Elector of the Hall of Fame.

Prof. Edgar Higgins was appointed Head of the department of Agronomy effective December 1, 1920, at the last meeting of the Board of Regents.

Doctor Roxas, of the department of Agricultural Organic Chemistry, visited the sugar centrals in Occidental Negros from December 22 to January 6, to make run tests. He spent one week at the Isabela Central and visited the centrals at Magdalena, Binalbagan, Ma-ao, Bugic, Bacolod, Murcia, and the Experiment Station at Iloilo and La Carlota.

Prof. Otto A. Reinking, of the department of Plant Pathology, visited the Mindoro Sugar Company at San Jose, Mindoro, during the Christmas vacation. During his two weeks' stay there he studied the various cane diseases found on the estate.

Dr. Foreman T. McLean, of the department of Plant Physiology, accompanied by Mrs. McLean and son, arrived at the College on January 6, 1921. He returned by way of South Africa and Australia from a year's leave of absence which was spent in the United States. The *Agriculturist* hopes to publish shortly a report of Doctor McLean's itinerary.

Prof. B. M. Gonzalez, of the department of Animal Husbandry, and Prof. Inocencio Elayda, of the department of Agronomy, visited Camp Stotsenberg, Pampanga, on December 28 and 29. Professors Gonzalez and Elayda are cooperating with Dr. Guy Potter Benton, educational adviser of the Philippine Department of the United States Army in determining the possibility of utilizing United States Army Posts in the Philippine Islands for raising crops and live stock as a part of the vocational training program of the United States Army. Professor Elayda will continue to study the prospects of agricultural training for six months and outline the projects with special emphasis for Philippine Scouts.

Prof. B. M. Gonzalez, of the department of Animal Husbandry, sailed for the United States on the S.S. *Nanking* on March 23 accompanied by Mrs. Gonzalez and their two sons. They will disembark at San Francisco and travel through the southern states to Baltimore. Professor Gonzalez goes as University Fellow to take advanced work in animal genetics under Doctor Pearl at Johns Hopkins University. Professor Gonzalez expects to remain in America about two years.

Jacob J. Wodrazka, of the department of English was promoted from assistant professor of modern languages to associate professor of modern languages effective October 1, 1920.

Mrs. James R. Gillis, formerly assistant professor of English, left for the United States on the U. S. A. T. *Madawaska* on January 19, 1921.

Prof. Jacob J. Wodrazka, of the department of English, made a trip through the southern Islands during the Christmas vacation. He visited the provinces of Mindoro, Antique, Iloilo, Cebu, Leyte, Samar, and Albay.

During the absence of Prof. B. M. Gonzalez, of the department of Animal Husbandry, Prof. A. S. Shealy will head that department.

Prof. Wodrazka, of the department of English, left for the states on the Thomas on March 15. He goes on leave of absence to visit his home and expects to return about July 1.

Mr. James R. Gillis resigned from the Bureau of Forestry, effective December 15, 1920. He was a member of the faculty of the Forest School when it was affiliated with the College of Agriculture.

Nicanor Teodoro, B. Agr. 1916 and government pensionado, received the degree of Master of Science at Wisconsin University 1920. He is specializing in plant pathology.

Francisco N. Fronda, B. Agr. 1919, a government pensionado, received the Master of Science degree from Cornell University, 1920. He is specializing in poultry husbandry and will continue his work for a doctor's degree.

Mr. Luis M. Alba, assistant in mathematics, has resigned, effective April 4.

The Board of Regents, at its meeting on March 7, designated Toribio Vibar, Agr. B., instructor in agronomy, and Vicente C. Aldaba, Agr. B. S., instructor in agronomy, as pensionados to go to the United States to specialize in their particular courses.

Colin Gilchrist Welles, M. S., has been appointed associate professor of plant pathology. Mr. Welles received his education at Cornell University and the University of Wisconsin, and held the position of assistant in agricultural bacteriology at the latter University before coming to the Islands. He arrived in the Islands on the S. S. *Kashima Maru* January 12, 1921.

Doris Berger Welles, B. A., has been appointed assistant professor of mathematics. Mrs. Welles is a graduate of the University of Wisconsin and arrived in the Islands January 12, 1921, on the *Kashima Maru*.

A letter to Dean Baker from Doctor Trelease, formerly of the department of Plant Physiology at the College, mentions the meeting of the Agricultural and Biological Section of the National Research Council in Washington at which Director Merrill of the Bureau of Science and Director Fischer of the Bureau of Forestry were present and spoke very highly of the College of Agriculture. In addition Dr. Wm. H. Weston of the United States Department of Agriculture, who it will be remembered conducted extensive research in corn disease at the College during 1919, especially emphasized the effective co-operation afforded him by Dean Baker and his staff and said that every facility for doing mycological and pathological research was offered him while here.

Doctor Trelease mentions also the meeting of the American Association for the Advancement of Science which met at Chicago in December of last year. Messrs. Uichanco, Santos, Quisumbing, Ocfemia, and Teodoro were present. It is very gratifying to know that the pensionados and fellows of the College are keeping in touch with this important forward movement of science which means so much for America and the world.

The Alumni of the College of Agriculture tendered a banquet to Dean Baker and Regent Gonzalez on March 6 at the Hotel de France, Manila. The festivity was in the nature of a *despedida* to the two guests of honor who are leaving the College shortly. President Albert was at the speakers' table. Doctor Mendiola, of the department of Agronomy, was toastmaster. Doctor Roxas, of the department of Chemistry, gave a very just and pointed exposition on Filipinization of the College of Agriculture. Professor Cuzner, of the department of Rural Engineering, spoke briefly on the same subject. Doctor Albert replied to a toast and assured the alumni of his great interest in the College. He further extolled the excellent records of the Dean and Professor Gonzalez, emphasized the confidence reposed in them and gave them his best wishes for their future. Professor Gonzalez in reply to his toast laid emphasis upon the spirit of devotion and service which he avers should be the lode-star of faculty, fellows, and students, stating that it was with this idea in view that he was going to America for further preparation. The banquet was marked for its wholesome simplicity and the family spirit that pervaded it.

The Board of Regents has voted the sum of forty thousand pesos for the construction of a central animal husbandry building with a stock pavilion adjoining it. It is planned to consolidate with this group of buildings the cattle

barns and silos provided for by the Experiment Station Act. Construction is expected to begin soon.

The two new dormitories for students are nearing completion and will be ready for occupancy by the opening of the next College year, June 6, 1921. The buildings are situated along Palm Row at the foot of Faculty Hill. The dormitories are of heavy timber construction and will accommodate thirty-six students each without crowding. The College has needed these buildings badly and they will relieve to a considerable extent the present unsatisfactory housing conditions. The construction has been under the supervision of Professor Cuzner and his assistants in the Rural Engineering department.

Ten of the herd of Hereford cattle at the College have been shipped to Salinas, Nueva Vizcaya. Ten head have been sent to the Trinidad Stock Farm at Baguio and three to the Department of Agriculture and Natural Resources to be used on their cattle ranches.

Four Hereford cows arrived at the College from Mindanao on October 22, 1920. They are part of the shipment which the Bureau of Non-Christian Tribes received from the United States some time ago. Since their arrival one calf has been born.

The Board of Regents has voted the sum of ten thousand pesos for the construction of four faculty cottages at the College of Agriculture. The erection of the houses is now well under way and they are expected to be ready for occupancy by June 1. Construction is under supervision of Professor Cuzner of the department of Rural Engineering. The houses are situated on Faculty Hill, two along Forestry Road and two fronting on Copeland Plaza. It is the intention of the Board of Regents to sell the houses to faculty members on an installment plan.

The department of Rural Engineering is supervising the construction of an additional wing on the Pathology and Entomology Building. It is planned for eventual use as a lecture hall but may be temporarily occupied by the College of Veterinary Science.

A new road has been constructed leading from Administration Plaza across the creek to the old swine yards. A heavy timber bridge spans the creek at the intersection of the road.

The College has received a new La Crosse tractor. It is of 12 to 24 horse power and should prove of great service in breaking new land on the Experiment Station. A Beeman small tractor has been also added to farm equipment. It is of the type of the garden tractor proving so useful in the United States for handling small culture plots.

Ramon V. Manio, B. Agr. 1919, resigned from the Bureau of Agriculture to take up farming in Dagupan, Pangasinan. He was assistant in rice breeding investigations at Alabang Farm.

Mr. Deogracias Villadolid, assistant in entomology, was united in marriage to Miss Restituta Salandanan at Calauang, Laguna, on January 9, 1921.

The Cine Makiling Company, its employees and the faculty gave a free show on December 31, to bid farewell to the old year. It was attended by the barrio people and the students.

A letter from Mr. Gerardo Ocfemia has been received by the Dean in which he especially mentions the last exposition number of the *Agriculturist* and requests

distribution of copies to an extensive list of scientists; a request which the College is most heartily glad to fulfill. Mr. Ocfemia is at the University of Wisconsin preparing himself for research and teaching of plant pathology. Report has it that he is doing very successful work and the College is deeply interested in his efforts.

Vicente Hidalgo, B. Agr. '19, has been appointed superintendent of the newly established Government stock farm at Dumarao, Capiz province. Mr. Hidalgo was recently married to Miss Angela Hidrosollo of Dumarao, Capiz.

Many students of the College will be interested in knowing that Paulino E. Costa, formerly a student here, is continuing his course in agriculture in the University of California. When he first arrived in America, he worked for a time on Doctor Copeland's rice farm. He is at present working his way in the University. This type of student is to be congratulated for uniformly successful effort in emulating the policy of work so familiar and traditional at the College of Agriculture.

COLLEGE OF VETERINARY SCIENCE NOTES.

Four new members have been added to the faculty of the College of Veterinary Science: Doctors Shealy, Koster, San Agustin, and Schwartz. Dr. Alonzo Shealy, B. S., D. V. M. was appointed professor of veterinary medicine. He received his bachelor of science degree at the Clemson Agricultural and Mechanical College of South Carolina in 1899. He then studied veterinary medicine at Iowa State College and was given the degree of D. V. M. in 1903. After graduation he was instructor in animal husbandry at the Clemson Agricultural and Mechanical College till December, 1904. In 1904 Doctor Shealy entered service of the Philippine Islands first in the veterinary department of the Bureau of Health and later in the same department of the Bureau of Agriculture. Except for two years during which he was a practicing veterinarian in Hongkong, Doctor Shealy has been continuously in the employment of the Philippine Government until his transfer to the University in November, 1920.

Dr. Louis P. Koster was appointed professor of veterinary physiology. He graduated from the College of Veterinary Medicine, University of Pennsylvania and received the degree of D. V. M. in 1912. From 1914 to 1917 he was transport veterinarian for the Italian government and made 14 trips across the Atlantic in charge of horses. In August, 1917, he entered the United States Army as second lieutenant of the veterinary corps and was promoted to first lieutenant in November, 1918. From April, 1918, to September, 1919, he saw service with the American Expeditionary Force, veterinary corps, in France. While in France he was promoted to captain.

Dr. Gregorio San Agustin was appointed assistant professor of veterinary anatomy. He graduated from the College of Veterinary Science, University of the Philippines, with the degree of D. V. M. in 1916. After graduation he was appointed instructor in veterinary anatomy and was later chosen as a University Fellow to study in the United States. He specialized in animal husbandry at the University of Wisconsin, animal nutrition at the University of Illinois, and in poultry husbandry at Cornell University.

Dr. Benjamin Schwartz, who has been appointed professor of protozoology and parasitology, in the College of Veterinary Science, arrived on the *Shinyo*

Maru, January 27, and has assumed his duties as head of the department of pathology and bacteriology in that College. Doctor Schwartz received the degree of A. M. from Columbia University in 1913 and Ph. D. from George Washington University in 1920. He has for the past five years served as parasitologist in the Bureau of Animal Industry, United States Department of Agriculture. He has contributed several papers on the fiddler crab, on ascaris, and on trichinae.

The Junior Class of the College of Veterinary Science tendered a banquet at the Ideal Hotel at Los Baños, to the members of the faculty on January 19, 1920. Speeches were delivered by the students and faculty members.

Dr. A. S. Shealy has been appointed acting dean of the College of Veterinary Science during the absence on leave of Dean C. F. Baker, effective June 1.

Lester C. Neer, D. V. M., has been appointed professor of veterinary physiology in the College of Veterinary Science. Doctor Neer is a graduate of Ohio State University and arrived in the Islands early in April.

Dr. A. K. Gomez, associate professor of veterinary bacteriology, has resigned, effective March 31.

Dr. Santiago Montemayor, instructor of veterinary anatomy, has resigned, effective March 31.

An isolation shed is in process of construction at the College of Veterinary Science. In addition, a concrete floor has been placed in the clinic.

WEATHER OBSERVATIONS, FEBRUARY, 1920.

Observer—R. P. Estioko

At College

Date.	Rainfall.		Temperature.				Wind.		Cloudiness.
	Daily.	Weekly.	Maximum.	Minimum.	Mean. Daily.	Mean. Weekly.	Daily.	Weekly.	
Feb.	*mm.*	*mm.*	°C.	°C.	°C.	°C.	*miles.*	*miles.*	
1	O		28.8	21.1	24.9		22.4		¼ cloudy
2	O		29.0	21.6	25.3		39.1		½ cloudy
3	T		29.0	23.4	26.2		30.5		¾ cloudy
4	O		28.5	21.6	25.1		92.7		½ cloudy
5	O		29.5	21.6	25.5		27.4		¼ cloudy
6	O		28.0	20.6	24.3		38.4		clear
7	O	T	28.8	21.6	25.2	25.2	18.3	263.3	¼ cloudy
8	O		27.5	20.6	24.0		35.6		½ cloudy
9	O		28.2	20.6	24.4		53.3		½ cloudy
10	14.5		25.0	21.1	23.1		32.5		cloudy
11	7.1		24.8	21.1	22.9		11.0		showers
12	1.0		27.0	21.8	24.4		62.1		½ cloudy
13	O		28.0	22.6	25.3		73.9		½ cloudy
14	19.5	42.1	26.5	21.6	24.1	24.0	20.4	288.8	showers
15	76.2		24.5	21.6	23.0		18.8		cloudy
16	T		28.0	23.1	25.6		64.7		cloudy
17	1.5		28.0	23.1	25.5		93.3		½ cloudy
18	O		28.5	22.6	25.6		50.9		½ cloudy
19	.9		28.0	21.6	24.8		47.4		cloudy
20	T		27.0	21.6	24.3		22.3		cloudy
21	O	78.6	28.0	20.6	24.3	24.7	30.1	327.5	½ cloudy
22	O		28.5	21.6	25.1		28.6		cloudy
23	O		28.5	21.6	25.0		126.3		½ cloudy
24	2.5		27.0	21.6	24.3		52.6		¾ cloudy
25	8.0		27.0	21.6	24.3		56.9		cloudy
26	.5		27.5	22.1	24.8		47.1		cloudy
27	1.1		25.8	21.8	23.8		38.3		cloudy
28	O	12.1	29.0	21.6	25.1	24.6	47.9	397.7	¾ cloudy
29	O		29.0	22.6	25.8		30.9		½ cloudy
Monthly		132.8	27.7	21.7	24.7		45.3	1313.7	

On Mount Makiling

Station on Mount Makiling.	Dates.	Rainfall.	Temperature. Maximum.	Temperature. Minimum.	Temperature. Mean.
			°C.	°C.	°C.
Coffee Plantation	Feb. 1 to Feb. 7	0.2	31.5	18.0	24.7
	Feb. 8 to Feb. 14	143.5	31.0	18.5	24.7
	Feb. 15 to Feb. 21	10.0	31.0	19.0	25.0
	Feb. 22 to Feb. 28	22.2	31.5	19.0	25.2
450 m. Elevation	Feb. 1 to Feb. 7	O			
	Feb. 8 to Feb. 14	115.8			
	Feb. 15 to Feb. 21	2.5			
	Feb. 22 to Feb. 28	23.5			
Summit	Feb. 1 to Feb. 7	2.1	19.5	16.7	18.2
	Feb. 8 to Feb. 14	122.8	18.0	16.6	17.3
	Feb. 15 to Feb. 21	13.1	18.6	17.1	17.8
	Feb. 22 to Feb. 28	26.7	18.3	17.1	17.7

WEATHER OBSERVATIONS, MARCH, 1920

Observer—R. P. Estioko

At College

Date.	Rainfall.		Temperature.				Wind.		Cloudiness.
	Daily.	Weekly.	Maximum.	Minimum.	Mean. Daily.	Mean. Weekly.	Daily.	Weekly.	
March	*mm.*	*mm.*	*°C.*	*°C.*	*°C.*	*°C.*	*miles.*	*miles.*	
1	0		28.0	21.6	24.8		131.3		½ cloudy
2	0		29.0	21.6	25.3		61.0		½ cloudy
3	0		28.0	22.6	25.3		38.3		cloudy
4	0		30.0	22.6	26.3		20.0		½ cloudy
5	0		29.0	22.6	25.8		33.6		¾ cloudy
6	0	0	27.0	23.6	25.3	25.5	36.1	351.2	¾ cloudy
7	0		29.0	22.6	25.8		67.1		¾ cloudy
8	2.0		29.5	21.6	25.5		15.7		¾ cloudy
9	0		30.0	22.1	26.1		20.6		clear
10	0		31.0	22.1	26.5		22.6		½ cloudy
11	0		30.0	22.4	26.2		31.5		½ cloudy
12	0		30.5	23.1	26.8		27.0		¾ cloudy
13	0	2.0	30.8	21.6	26.2	26.2	33.2	217.7	¼ cloudy
14	0		29.2	21.1	25.1		25.6		¼ cloudy
15	0		26.6	22.4	24.5		16.2		¾ cloudy
16	7.5		30.0	23.6	26.8		23.1		½ cloudy
17	0		28.0	22.4	25.2		24.8		½ cloudy
18	0		29.5	22.6	26.1		50.2		¾ cloudy
19	.5		27.8	21.8	24.8		29.9		½ cloudy
20	.2	8.2	30.0	22.6	26.3	25.5	36.6	216.4	½ cloudy
21	0		30.6	21.6	26.1		24.9		½ cloudy
22	0		30.4	22.2	26.3		29.6		clear
23	0		31.5	22.6	27.0		43.5		½ cloudy
24	0		30.0	21.6	25.8		45.8		¼ cloudy
25	0		30.0	22.2	26.1		56.6		½ cloudy
26	6.5		28.0	22.6	25.3		56.2		¾ cloudy
27	0	6.5	29.0	22.0	25.5	26.0	71.2	327.8	¼ cloudy
28	3.2		30.0	22.4	26.2		31.8		cloudy
29	0		29.0	22.1	25.6		69.5		cloudy
30	0		30.8	22.6	26.7		35.1		clear
31	0		31.0	22.6	26.8		28.3		cloudy
Monthly		19.9	29.5	22.3	25.9	25.8	43.45	1346.9	

On Mount Makiling

Station on Mount Makiling.	Dates.	Rainfall.	Temperature. Maximum.	Minimum.	Mean.
			°C.	*°C.*	*°C.*
Coffee Plantation	Feb. 29 to Mar. 6	2.5	33.5	19.0	26.2
	Mar. 7 to Mar. 13	2.6	34.5	18.0	26.2
	Mar. 14 to Mar. 20	14.2	34.8	19.0	26.9
	Mar. 21 to Mar. 27	10.2	34.5	18.5	26.5
450 m. Elevation	Feb. 29 to Mar. 6	4.1			
	Mar. 7 to Mar. 13	1.8			
	Mar. 14 to Mar. 20	13.1			
	Mar. 21 to Mar. 27	8.4			
Summit	Feb. 29 to Mar. 6	6.0	18.9	17.3	18.1
	Mar. 7 to Mar. 13	3.2	20.2	17.2	18.7
	Mar. 14 to Mar. 20	23.2	19.3	17.4	18.4
	Mar. 21 to Mar. 27	11.2	19.0	17.4	18.2

WEATHER OBSERVATIONS, APRIL, 1920.

Observer—R. P. Estioko

At College

Date.	Rainfall.		Temperature.				Wind.		Cloudiness.
	Daily.	Weekly.	Maximum.	Minimum.	Daily.	Weekly.	Daily.	Weekly.	
April	*mm.*	*mm.*	*°C.*	*°C.*	*°C.*	*°C.*	*miles*	*miles*	
1	0		30.5	22.4	26.4		30.2		¼ cloudy
2	0		31.2	21.8	26.5		12.8		¼ cloudy
3	0	0	30.3	23.2	26.8	26.4	8.8	216.5	½ cloudy
4	0		31.1	23.4	27.2		43 1		¼ cloudy
5	0		31.4	22.6	27.0		30.1		¾ cloudy
6	0		32.2	22.6	27.4		23.8		½ cloudy
7	10.5		30.5	21.8	26.2		31.2		cloudy
8	2.5		31.0	21.6	26.3		15.1		½ cloudy
9	0		31.6	21.6	26.6		27.9		½ cloudy
10	0	13.0	32.0	23.0	27.5	26.9	28.2	199.4	cloudy
11	0		32.0	23.1	27.5		37.9		½ cloudy
12	T		31.8	24.1	28.0		14.9		cloudy
13	1.2		32.0	23.9	27.9		17.8		cloudy
14	2.5		30.5	24.1	27.3		7.2		cloudy
15	0		32.1	23.4	27.8		10.0		¾ cloudy
16	0		31.5	23.6	27.5		10.2		½ cloudy
17	0	3.7	32.0	23.1	27.6	27.7	30.4	128.4	½ cloudy
18	0		32.0	23.2	27.6		68.3		½ cloudy
19	0		32.0	22.6	27.3		35.5		½ cloudy
20	0		32.8	22.6	27.7		36.9		¼ cloudy
21	0		32.0	22.6	27.3		24.1		clear
22	0		30.5	22.6	26.5		21.2		½ cloudy
23	0		33.0	22.6	27.8		52.6		½ cloudy
24	T	T	33.0	22.8	27.9	27.6	43.2	281.8	½ cloudy
25	T		32.2	24.8	28.5		29.8		¾ cloudy
26	0		32.8	24.4	28.6		28.7		¼ cloudy
27	0		31.8	23.6	27.6		30.0		¾ cloudy
28	0		32.2	24.1	28.2		24.7		¾ cloudy
29	0		32.5	24.7	28.6		25.0		¾ cloudy
30	0	T	33.0	24.1	28.5	28.3	23.0		½ cloudy
Monthly		16.7	31.8	23.1	27.5	27.4	27.4	822.6	

On Mount Makiling

Station on Mount Makiling.	Dates.	Rainfall.	Temperature.		
			Maximum.	Minimum.	Mean.
Coffee Plantation	Mar. 28 to Apr. 3	0	35.2	19.9	27.5
	Apr. 4 to Apr. 10	10.5	36.0	18.5	27.3
	Apr. 11 to Apr. 17	T	35.0	20.0	27.5
	Apr. 18 to Apr. 24	T	35.2	20.0	27.6
	Apr. 25 to May 1	20.7	35.0	19.2	27.1
450 m. Elevation	Mar. 28 to Apr. 3	0			
	Apr. 4 to Apr. 10	10.5			
	Apr. 11 to Apr. 17	0			
	Apr. 18 to Apr. 24	0.2			
	Apr. 25 to May 1	21.2			
Summit	Mar. 28 to Apr. 3	1.1	18.9	17.1	18.0
	Apr. 4 to Apr. 10	1.6	19.9	17.7	18.8
	Apr. 11 to Apr. 17	0.4	21.7	18.6	20.2
	Apr. 18 to Apr. 24	1.7	21.0	18.6	19.8
	Apr. 25 to May 1	40.3	21.9	18.7	20.3

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